DOCUMENT RESUME

ED 074 237 VT 019 503

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TITLE	Structural Elaboration of Roe's Classification of Occupations.
INSTITUTION	Israel Program for Scientific Translation, Jerusalem.
REPORT NO	IPST-10448
PUB DATE	68
NOTE	120p.
EDRS PRICE	MF-$0.65 HC-$6.58
DESCRIPTORS	Adolescents; *Classification; Cluster Grouping; Correlation; Foreign Countries; Males; Occupational Clusters; *Occupational Guidance; *Occupations; *Vocational Counseling; Vocational Development; *Vocational Interests
IDENTIFIERS	*Israel

ABSTRACT

To find a method for making better use of vocational interests in occupational guidance, Roe's occupational classification system was tested. A search was made to determine whether this system would yield a contiguity structure of occupations, by interests, showing the relationships between interests in different types of occupations. Three samples, consisting of 1,114 Israeli boys aged 13-14, were given one of three interest questionnaires, each containing about 100 names of occupations. In each sample of test subjects, Pearson correlations between groups of occupations belonging to the same level field were obtained and then tested to determine whether they were consistent with Roe's theory (i.e. existence of a graded order of levels in each field and a circular, single-deviational structure of fields in each level) or some other pattern useful for occupational guidance. Some results were: (1) A graded order of levels of occupations was found in Service, Business, Organization, Technology, Outdoor, Science, General Cultural, and Arts and Entertainment fields, (2) Service, Organization, Business, Technology, and Outdoor fields were arranged in a simplex structure, (3) Business, Service, General Cultural, and Science fields comprised another simplex structure, and (4) The Arts and Entertainment field could not be incorporated in either structure, while Business and Service fields appeared in both. (SB)

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Structural Elaboration of Roe's Classification of Occupations

ACADEMISCH PROEFSCHRIFT

TER VERKRIJGING VAN DE GRAAD VAN DOCTOR IN DE SOCIALE WETENSCHAPPEN AAN DE UNIVERSITEIT VAN AMSTERDAM, OP GEZAG VAN DE RECTOR MAGNIFICUS MR. J. VAN DER HOEVEN, HOOGLERAAR IN DE FACULTEIT DER RECHTSGELEERDHEID, IN HET OPENBAAR TE VERDEDIGEN IN DE AULA DER UNIVERSITEIT (TIJDELIJK IN DE LUTHERSE KERK, INGANG SINGEL 411, HOEK SPUI) OP VRIJDAG 21 JUNI 1968 TE 16.00 UUR

door

ELCHANAN ISRAEL MEIR

GEBOREN TE JERUSALEM

Jerusalem, Israel
1968

PROMOTOR: PROF. DR. S. WIEGERSMA

COREFERENT: PROF. DR. A. D. DE GROOT

IPST 10448

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Produced by Publication Services Division
of the Israel Program for Scientific Translations
Jerusalem, Israel

To my wife

PREVIEW

In this study we tried to find a method by which information on vocational interests may be put to better use in occupational guidance. Most of the existing classifications of occupations consist of lists of names, each representing a group of occupations, which may be shifted about at will without there being any definite relation between one group and another.

We tried to go one step further and find a contiguity structure of occupations, by interests, showing the relationships between interests in different types of occupations.

> "The basic idea in contiguity is *order*, a sequence of stages such that no factor can be common to two remote stages without being common to all the stages inbetween, and to this notion the idea of dimensionality is essentially irrelevant . . . the idea of contiguity is purely ordinal and we do well not to read into it any kind of parametric relationship." (Jones, 1960, p. 14).

To arrive at such a structure we first needed a classification of occupations suitable for our purposes. After examining various classifications we found that Roe's system, based on levels and fields which roughly correspond to capabilities and interests, seemed to meet our requirements. We then decided to test whether this classification would yield an appropriate structure. The main method of research was to obtain correlations between groups of occupations, each group consisting of occupations belonging to the same level and field, and then testing whether these correlations fitted in a pattern consistent with Roe's theory or some other pattern useful for occupational guidance.

My deepest thanks are due to Prof. Dr. S. Wiegersma, the promotor of this thesis, for his extremely valuable help and guidance in the preparation of this work. My thanks are also due to Prof. Dr. A. D. de Groot, who acted as co-referent, for his most useful suggestions.

Further I wish to thank Prof. H. Kreitler and Dr. R. Shuval for their helpful comments and encouragement.

The assistance given to me by Mr. J.C. Helbing, and Mr. S. Colthof is deeply appreciated. Many thanks are due to Mrs. H. Schmorak for translating this work and to Mrs. S. Farhi for her services as typist.

I am much obliged to Tel-Aviv University for its financial support which has made it possible for me to accomplish this work and to Mr. Z. Sardi of the Hadassah Vocational Guidance Institute for his support.

Elchanan I. Meir

February, 1968

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PART ONE: *Introduction*

CHAPTER ONE: OCCUPATIONS

1. WHAT IS AN OCCUPATION?

This is a study about occupations and occupational structure. Before going into the classification and structure of occupations by interests—our subject proper—we ought to define what is meant by occupation.

> "The terms 'work', 'occupation', 'job' and 'position' are often used loosely and more or less interchangeably, but preferably with precise and distinctive meanings." (Super, 1957, p. 8).

There are a number of definitions of "occupation" which, though they do not vary widely from one another, are still not quite identical. For a better understanding of the term as used here it seems best to explain it in context with the related terms —work, task, position and job.

A man has to work in order to live. With few exceptions people cannot get on for any length of time without working. Even when theoretically a person might stop working without fear of starvation he usually goes on. Work in this sense is something that involves an investment of energy. As defined by *Webster's Third New International Dictionary*, 1961, work is an "activity in which one exerts strength or faculties to do or perform."

One of the differences between different types of work lies in the task in which the energy is invested. Some types of work are confined to a single task, where the same action (or group of actions) is constantly repeated. These are the simpler types of industrial work such as those using a conveyor belt. Most work, however, involves more than one task.

The degree to which any kind of work is divided up into tasks varies with the object for which the division is made. When it is intended to describe the nature of the specific work to somebody not familiar with it, the division would naturally be less detailed than in an analysis designed to streamline the work and cut out superfluous tasks. While in work the activity aspects are stressed more, i.e. the performance of actions other than mere biological functions, in task the main stress is on the content of the action. Neither relates to the person doing the work or performing the task. On the other hand "position, "job" and "occupation" refer to the work done in context with the person doing it. Hence these are the terms generally used in psychology.

Position—Job—Occupation

Shartle (1959) defines *position* as:

> "a group of tasks performed by one person. There are always as many positions as there are workers in a plant or office." (p. 23).

Job is a wider term than position and is defined by Shartle as:

> "a group of similar positions in a single plant, business establishment, educational institution, or other organization. There may be one or many persons employed in the same job." (p. 23).

Occupation is defined with the aid of the preceding concepts as a more general term than either task, position or job. Shartle defines *occupation* as:

> "a group of similar jobs found in several establishments." (p. 23).

According to Shartle the tasks performed by one worker constitute his position. When there is more than one worker performing the same tasks in the same place of work we refer to these tasks as their job. When there are people in different places of work all doing the same tasks, we speak of these tasks as their occupation. The particular tasks done by a worker in a given establishment are his job in that establishment. If two people perform the same tasks in different shifts, they have the same job but hold two positions. Thus inside an establishment each worker has a position and a job. The sum of tasks comprised in a person's position or job, or of similar tasks which might be performed by him in another, similar enterprise, is his occupation. To quote Shartle:

> "John Jones has a position as employment interviewer in an employment office. Two other persons are employed in this same work in the office, making a total of three positions. The three positions grouped together are a job. The occupation, employment interviewer, is a group of similar jobs found in several employment services." (p. 23).

Wiegersma (1962) distinguishes between position—werkkring, in Dutch— and occupation—beroep. Wiegersma's definition of position—werkkring—is:

> "The (more or less permanent) characteristics of the tasks given to an individual worker within the division of work in a society where work is an economic asset."[1]

[1] "Werkkring: de (min of meer permanente) karakteristiek van de taken, die aan een individuele werker, in het kader van een arbeidsverdeling binnen een gemeenschap, waarin arbeid een economisch goed is, worden toebedeeld. (p. 21)

Occupation (beroep) is defined as:

> "The sum of mutually related tasks within the division of work in a society where work is an economic asset, characterized by the fact that the nature of and interrelationship between the tasks is in the main independent of the organization in which the work may be performed."[2]

Wiegersma suggests the further concept of function (functie) more or less corresponding to Shartle's "job". Function is defined as:

> "The sum of mutually related tasks within the division of work in an organization forming part of a society whose economy is based on labour where the nature of the associated tasks is determined mainly by the norm prevailing within the organization."[3]

Wiegersma's description of the development of occupations is as follows: at first every worker worked on his own. In the course of time people began to work together, dividing the work between them. Each one did a certain task or a number of tasks according to how the organization in which he worked thought that the work should be divided up. Since most organizations think more or less on the same lines in this matter—because of the technological nature of the work or because a certain division is the most economical, or simply out of conformism—the functions developed into occupations. Thus a foreman's work at one time included a variety of functions, but gradually the idea of a foreman came to denote a specific function. This resulted in a certain standardization of the foreman's tasks and eventually the sum of the tasks to be performed by a foreman became a separate occupation, as may be seen from the fact that there are special training courses for foremen.

There are also other definitions of "occupation". Roe (1956), for instance, includes in this term . . . "whatever an adult spends most of his time doing" (p. 3). This definition is of little help in deciding which occupations are related and which are not, and what constitute different occupations. According to Roe, occupation is not only what people generally mean by this term, but would also seem to include hobbies and other non-gainful activities.

There seems little point in further semantic discussion, which only seems to lead us off the track. The object of our book is the structure of occupations. We need

[2] "Beroep: een geheel van bijeenbehorende taken, in het kader van de arbeidsverdeling binnen een gemeenschap waarin arbeid een economisch goed is, gekenmerkt door het feit, dat de aard en de onderlinge samenhang van deze taken in hoofdzaak onafhankelijk zijn van de organisatie, waarbinnen de arbeid eventueel wordt werricht." (p. 20)

[3] "Functie: een geheel van bijeenbehorende taken in het kader van de arbeidsverdeling binnen een organisatie, die deel uitmaakt van de economische arbeidsgemeenschap, waarbij de aard van de gebundelde taken voornamelijk wordt bepaald door de opvattingen, die in deze organisatie heersen." (pp. 20–21)

a narrow definition which would be helpful in distinguishing between different types of occupations:

> ". . . the term must cover three different sets of facts: technological—the specific manual or mental operations involved in the execution of occupational work; economic—the income yield of an occupation which serves to provide a livelihood; and social—the prestige attaching to a person or group by virtue of occupation." (*Encyclopaedia of the Social Sciences*, p. 424).

We have therefore preferred to use the more limited definition found in the literature —that of Wiegersma, which as stated does not materially differ from that of Shartle.

2. SIMILARITIES AND DIFFERENCES BETWEEN OCCUPATIONS

As we have shown in the previous section, every occupation consists of a number of tasks so that a given combination of tasks or task set constitutes one occupation while a different set constitutes another. A specific task, on the other hand, may be included in more than one occupation. Thus letter-writing is one of the tasks of a secretary, a lawyer, a building contractor and a university lecturer. Conversely the tasks included in one occupation are not necessarily similar to each other in all respects.

Analysis shows that more or less the same set of tasks—determined by requirements of efficiency and by prevailing norms—is always found in what we refer to as the same occupation. This in fact is what makes it possible to speak of an occupation.

Similar means having characteristics in common. Two occupations are similar insofar as they share a number of characteristics or tasks: they are not similar if they have no characteristics or tasks in common or if most of the salient ones are mutually exclusive and different.

From the very definition of "occupation" it is clear that two occupations can never have exactly the same characteristics, for then they would constitute not two but one single occupation, though possibly called by different names.

With regard to the similarity of occupations a very large list of characteristics can be drawn up and compared. This may be a useful intellectual exercise but hardly leads to any concrete results. Among this vast number of characteristics, however, there are some which are widely used by psychologists—and sometimes also by the man in the street. They usually apply only to a small number of specific aspects. Some which are in current everyday use are the level of income, the specific or general level of aptitudes, the physical effort required, and the degree of independence offered by various occupations. Less commonly used are such criteria as the relation of occupations to food, or to animals, or the initial means required for practice or training, the tools and instruments used, etc.

Vocational counsellors tend to compare occupations by the degree of similarity in general intelligence, specific aptitutes, number of years of general education and specific training and supervision, interests, character traits, environmental factors, physical effort, repetitiveness of the work, social status (including income, prestige and nature of social contacts), working conditions, type of establishment, purpose (production, services, art, etc.) and the amount of risk involved. Other criteria are occasionally used, but these are the more common ones. Accordingly, there are many criteria for the similarity of occupations, and the selection of appropriate criteria naturally has to be determined by the kind of similarities or differences it is intended to convey. This will be dealt with in the following chapter.

CHAPTER TWO: CLASSIFICATIONS

In this chapter we intend to deal generally with problems of taxonomy. In the next chapter we shall show why Roe's classification of occupations was preferred for our purposes.

A classification is useful only if it serves the required purpose. One of the objects of the classification is to reduce the number of discrete items or units dealt with into more or less homogeneous groups which are easier to handle. Another object of classification is to bring out the similarities and differences between the attributes of the various items after they have been sorted into groups. Most classifications in fact combine both purposes—reduction in the number of items and bringing out the similarities and differences between attributes.

Classifications differ not only in the object they are supposed to accomplish but also in type. There are inclusive and exclusive classifications and classifications with and without further sub-divisions.

Exclusive classifications are those where items, once they have been included in one category, can no longer be included in any other. Exclusive classification is used, for example, in dividing children among elementary schools: each child can be in no more than one school, but some children may be in none.

Inclusive classifications are those where each item can be comprised in at least one group or category. A classification is also inclusive if items not attributed to any specific group are lumped under "other" or "miscellaneous"[1]. Classifications may be both inclusive and exclusive, and in that case they are called partitions, but as Hempel (1952) says:

> "Of greater significance for empirical science, however, is the case where at least one of the conditions of exclusiveness and exhaustiveness [i.e. inclusiveness] is satisfied not simply as a logical consequence of the determining criteria but as a matter of empirical fact; for this indicates an empirical law and thus confers some measure of systematic import upon the classificatory concepts involved." (p. 51)

Sometimes the classification yields a number of categories of the same order, which cannot or need not be further sub-divided. In many instances, however, at least one further sub-classification is made. The first kind of classification is obviously

[1] According to the terminology and symbols of set theory:
A = set of all cases $a = \{a_i\}$
$A_k \subset A (k = 1,2,\ldots,K) \ldots K$ subsets of the classification.
Exclusiveness: $A_k \cap A_l = \phi$ for every $k \neq l (k, l = 1,2,\ldots,K)$
Inclusiveness: $A_1 \cup A_2 \cup \ldots, \cup A_{k-1} \cup A_k = A$

less complex. It is used mainly when the number of items is not very big and is sufficiently reduced by one classification, or when the differences and similarities of the attributes are brought out clearly enough. Several further classifications are usually made when there is a large number of items and the first classifications, in which only one characteristic is taken into account, leaves too many categories of the same level of generalization.

If more than one classification is made, the second classification may be based on the first and may be subsidiary to it. This is a sub-classification. Alternatively it may be on the same level as the first classification, but based on different dimensions, i.e. different and not necessarily related criteria of classification are used. This is what is known as a cross-classification. A library is a good example of a sub-classification while, for instance, the indication of points on a map by longitude and latitude represents a cross-classification with a number of parallel dimensions.

Another important formal difference is whether a classification or sub-classification depends on nominal, ordinal or metric distinctions between classes or sub-classes. When a nominal scale is used, the criteria are generally given or construed as dichotomies: the presence or absence of an attribute. If a metric scale is used, decisions on cutting points are required. Ordinal groupings are generally based on assumed quantitative distinctions in a dimension for which no metric scale is available. The question which scale should be chosen depends on the nature of the material at hand.

We shall discuss in more detail two principal classification methods—classification by experts and by factor analysis. According to the first method, experts classify the raw material according to the purpose, the inclusivity or exclusivity, and the type of sub-divisions required, if any. In factor analysis the material is fed into a computer which sorts it according to a predetermined programme, solely by the size of the correlations between the items. The resulting clusters may be regarded as homogeneous groups and labelled by the persons evaluating the material according to the attributes the groups are supposed to represent.

In both methods human evaluation plays a role. In the first case a man enters the picture from the start, in the second only after having obtained certain results from the computer. Even here the programme of the computer is predetermined. We agree with Hempel and Oppenheim (1936) that

> "The difference is one of degree only: when the difference in weight is sufficiently small, two balances no longer produce exactly the same results (for instance, a less sensitive scale is balanced where a more sensitive one still shows a difference in weight—corresponding formally to the difference in the sensitivity threshold of different people in their ability to make distinctions); conversely, in certain cases the evaluation method by different experts may result in quite satisfactory agreement." (p. 60, translated from German).

The number of occupations is huge so that it is necessary to work with a sample

of them. If the study is to be replicated, a new sample of occupations is taken. In the first method experts will have to classify further occupations by the same rules as were applied in the initial classification. In the second method the computer is fed with a new list of occupations. If the first method is used then in any list of occupations classified by the same rules, the same arrangement of the various classes of occupations will probably be the same. In case the factor analysis method is used a way must be found to label the appropriate factors found in each sample so that predictions can be made for other occupations as well.

Factor analysis seems to be the easier method in the first stage of research, but when it comes to drawing general conclusions certain complications arise. We preferred the method of initial classification by experts.

CHAPTER THREE: THE CHOICE OF ROE'S CLASSIFICATION OF OCCUPATIONS

The number of occupations is much too large to be meaningfully investigated without prior classification. Not only is it almost impossible to determine the relations between them, but every person tends to conceive of the individual occupations in a slightly different manner. In using categories or groups of occupations the effect of individual idiosyncracies and attitudes is minimized. It was also necessary to reduce the vast number of occupations by ignoring minor differences and speaking, for instance, of a cabinetmaker and not of makers of antique and modern furniture, chairs, tables, beds, etc.

The extant classifications of occupations are many, and for discussion of some of them we refer the reader to Wiegersma's *Psychologie van beroep en beroepskeuze* (1967) or to Super's *The Psychology of Careers* (1957).

We were primarily interested in finding a classification that could serve as a suitable starting point for our research into the existence of a structure of occupations by interests. The classification for this purpose was Roe's classification as set out in *The Psychology of Occupations* (1956). This classification comprises two dimensions: level and field. Level is related to aptitude, training, responsibility and similar attributes which play a role in vocational guidance. Field is the dimension which gives information on the contents of the occupation, and is therefore particularly relevant to a classification by interests. These two dimensions are orthogonal to each other.

In Roe's classification the occupations are divided into six levels:

"*Level* 1: PROFESSIONAL AND MANAGERIAL 1: INDEPENDENT RESPONSIBILITY: This level includes not only the innovators and creators, but also the top managerial and administrative people, as well as those professional persons who have independent responsibility in important respects. For occupations at this Level there is generally no higher authority, except the social group. Several criteria are suggested: a. Important, independent, and varied responsibilities. b. Policy-making. c. Education: When high-level education is relevant (it is not required in the creative arts, for example, or a necessity for dictators, or even for our own high government officials) it is at the doctoral level or the equivalent.

Level 2: PROFESSIONAL AND MANAGERIAL 2: The distinction between this Level and Level 1 is primarily one of degree. Genuine autonomy may be present but with narrower or less significant responsibilities than in Level 1. Suggested criteria are: a. Medium-level responsibilities, for self and others, both with regard to importance and variety. b. Policy interpretation. c. Education at or above the bachelor level, but below the doctorate or its equivalent.

Level 3: SEMI-PROFESSIONAL AND SMALL BUSINESS: The criteria suggested here are: a. Low-level responsibility for others. b. Application of policy, or determination for self only (as in managing a small business). c. Education, high school plus technical school or the equivalent.

Level 4: SKILLED. This and the following levels are classical subdivisions. Skilled occupations require apprenticeship or other special training or experience.

Level 5: SEMI-SKILLED. These occupations require some training and experience but markedly less than the occupation in Level 4. In addition, there is much less autonomy and initiative permitted in these occupations.

Level 6: UNSKILLED. These occupations require no special training or education and not much more ability than is needed to follow simple directions and to engage in simple repetitive actions. At this Level, Group differentiation depends primarily upon the occupational setting.

The occupations are further divided into eight fields (Roe called them "Groups"):

I. SERVICE. These occupations are primarily concerned with serving and attending to the personal tastes, needs, and welfare of other persons. Included are occupations in guidance, social work, domestic and protective services . . .

II. BUSINESS CONTACT. These occupations are primarily concerned with the face-to-face sale of commodities, investments, real estate, and services. Also included are such occupations as demonstrator, auctioneer, and some kinds of agents. A distinction is made in sales occupations between those in which the job is personal persuasion, which belong here, and those in which the selling is routine, and the person-to-person relation relatively unimportant, which belong in the next Group . . .

III. ORGANISATION. These are the managerial and white collar jobs in business, industry, and government, the occupations concerned primarily with the organization and efficient functioning of commercial enterprises and of government activities . . .

IV. TECHNOLOGY. This Group includes occupations concerned with the production, maintenance, and transportation of commodities and utilities. Here are occupations in engineering, crafts (including repair work), and the machine trades, as well as transportation and communication . . .

V. OUTDOOR. This Group includes agricultural, fishery, forestry, mining, and kindred occupations: the occupations primarily concerned with the cultivation, preservation, and gathering of crops, of marine or inland water resources, of mineral resources, of forest products, and of other natural resources, and with animal husbandry . . .

VI. SCIENCE. These are the occupations primarily concerned with scientific theory and its application under specified circumstances, other than technology . . .

VII. GENERAL CULTURAL. These occupations are primarily concerned with the the preservation and transmission of the general cultural heritage. The Group embraces occupations concerning the subjects usually called the humanities in college catalogues, but it is broader than these. It includes occupations in education, journalism, jurisprudence, the ministry, linguistics, and so on. All elementary and high school teachers are included in this Group. . .

VIII. ARTS AND ENTERTAINMENT. These occupations include those primarily concerned with the use of special skills in the creative arts and in the field of entertainment. Both creators and performers are included . . ."
(Roe, 1956, pp. 145-147).

The choice of Roe's classification of occupations was determined by its following advantages:

1. It brings out similarities and dissimilarities between occupations on a psychological basis, which is obviously a great advantage for vocational guidance purposes.

2. It aspires to being both inclusive and exclusive. In view of its inclusiveness agreement between the experts classifying the material may be easily reached. In view of its exclusiveness correlations between different groups of occupations may be computed.

3. It consists of two dimensions—levels and fields—of which the one generally corresponds to abilities and the other one to interests. These probably are the most important dimensions in vocational guidance. If there were more dimensions the actual work of classification would be too complicated. If there were only one dimension, the number of categories would be too big to handle, or salient differences between occupations would have to be overlooked in trying to reduce their number. The orthogonality of the two dimensions has the advantage of meaningfully reducing the number of categories. There may be other classifications of occupations which have the same advantages but Roe's was the best one of those known to us when we began our research.

4. It moreover already contains some hints of a structure of occupations:

". . . Contiguous cells are related. Levels are arranged in hierarchical order . . . Groups are so arranged that, with one exception, contiguous ones are more closely related than noncontiguous ones . . . The arrangement should be thought of as circular . . ." (Roe, 1956, pp. 144–145).

The division into levels implies differences in height or standard. They are obviously ranged along a continuum. When data are ranged along a continuum a

decision is required on borderline cases – items on the cutting points between the groups. It has to be decided whether they belong to one group or the other.

> "A group of items with fluid boundary lines cannot be conceptually determined by setting up an indistinct definition of a category and in doubtful cases leaving it to the discretion or scientific tact of the individual to decide whether an item is still sufficiently similar to those which doubtlessly belong to that category, i.e. whether it still belongs to that group or not." (Hempel and Oppenheim, 1936, p. 44, translated from German).

To obviate this difficulty it is necessary to decide on accurate criteria for the definition of the levels and to devise suitable methods to ensure a maximum of reliability. Reliability can be tested by either computing correlations between the categories, or percentages of agreement between experts. We chose the latter method, which has the advantage of greater simplicity.

Since the occupations in each level are not precisely of the same level but only within certain limits, the levels were therefore regarded not as lines but rather as strata covering a certain range.

After starting research with Roe's classification as a basis, van Mill's classification (1952) came to our knowledge. This classification has some similarities with Roe's— it also has a dimension of level (Beroepenklassen) and of field (Beroepenfamilies). A third dimension is physical effort (Lichamelijke inspanning). There are seven levels which were proven by Wiegersma (1961) to be unidimensional.

A comparison of this classification by levels and Roe's classification is given in Appendix A. Altogether the number of criteria by which occupations may be divided into levels is considerable: aptitude, intelligence, education, training, degree of subordination, responsibility, level of income, degree of routine and complexity of work, etc. For instance Guttman (1964), in establishing a civil service classification for Israel, decided on five criteria: initiative, judgment, contact with people, verbal ability and independence. All these criteria are intimately related so that it does not seem to matter very much which of them are used, in accordance with the number of divisions and categories required.

For his classification by fields van Mill used combinations of ten different criteria ("aspects"). This set of criteria seemed too sophisticated for our purposes.

The choice of Anne Roe's classification to some extent predetermines the structure of occupations ultimately established on the basis of our findings. Had another classification been chosen we might have arrived at a somewhat different structure. However, for all the reasons set out above—simplicity, general applicability, usefulness for vocational guidance—it was considered the most suitable.

CHAPTER FOUR: EVALUATION OF ROE'S CLASSIFICATION

Roe divided the occupations into eight fields and six levels, that is, into 48 cells or clusters. According to Super (1957) this is "the most logical and practically useful two-dimensional classification available." (p. 47)

Super and Overstreet (1960), in a study of occupational maturity, used the ranking of Anne Roe in evaluating the distance between levels though not between fields. Subjects who chose occupations from the same or from related levels were considered more occupationally mature than those who chose occupations from widely different levels. When the subject chose two occupations from the same field the score was zero and when he chose two occupations from two different fields, the score was one. The distance between levels was scored from 1 to 5 according to Anne Roe's indications. The authors regarded the structure of the levels as fairly well established, but were doubtful as to the structure of the fields and therefore did not base their scoring on the distances between them.

Osipow (1966) tried to test the stability of occupational choices on the basis of Anne Roe's structure. According to him:

> "occupations in categories adjacent to one another are more similar in climate than occupations in categories far removed from each other." (p. 285)

He attempted to assess the degree to which a second occupational choice falls into the same or adjacent categories as the first choice. The first two vocational preferences were classified into Roe's system for each subject, and the differences in the fields were scored accordingly. He concluded that:

> "most of the subjects expressed second choices which represent jobs in the same category of classification as their first choices, and many expressed second choices in an adjacent category, while few have second choices two or more categories removed from their first choice." (p. 286)

LoCasio found a relationship between vocational preference implementation (immediate, delayed and non-implementors) and a low score in change of field preferences (Chi-square statistic, 2 df.). However, this using the fields of Roe's classification hardly seems to confirm Roe's specific arrangement of fields.

It appears that Anne Roe's classification, and her suggested structure, are generally considered a good basis for research. Yet Roe arrived at her structure without empirical evidence. It was probably based on a partial analysis mentioned subsequently in 1957 and on the findings of Guilford et al. and other authors. In 1956 Fine said that: "The groups, entitled Service, Business Contact, . . ., can roughly be identified with interest factorization." (p. 260). Anne Roe herself and others like Utton (1962), Hagen (1960) and Grigg (1959) used her classification and structure mainly for the investigation of fairly unrelated psychological aspects, such as the origin of interests. It would accordingly be most useful to test this struc-

ture and in case it does not hold good to suggest a valid alternative on which future investigations might be based, especially since there seems to be a lack of good classifications of occupations from the psychological aspect. This is especially so, since as Fine pointed out:

> ". . . while there is enough data in the studies she reviews to suggest her structure, there is not enough to confirm it . . . It is particularly lacking for lower level jobs. For example, her structure assumes that you can discriminate interests on lower level jobs, as well as you can on upper level jobs . . . This at present is difficult to demonstrate with the data at hand. It further assumes that level differences are roughly the same as between Practical Nurses and Taxi Drivers, Auctioneers and Peddlers, and Electricians and Smelter Workers . . . Here again the evidence available to work with is entirely inadequate." (1956, p. 260).

As stated, we chose Anne Roe's classification as set out in her book *The Psychology of Occupations*, published in 1956. In her various writings the classification used has not always been the same, and other authors have also introduced modifications. These modifications relate mainly to the fields. The different versions are set out in the following table.

TABLE 1
COMPARISON BETWEEN FOUR VERSIONS OF ROE'S CLASSIFICATION BY FIELDS.

Roe's original fields (1954)	*Moser, Dubin & Shelsky (1956)*	*Roe (1956)*	*Super (1957)*
Social and personal service	Service	Service	Social-personal
Persuasive business	Business contact	Business contact	Business contact
Government,	Business administration and control	Organization	Administration control
Industry	Technology	Technology	—
Physical	Outdoor	Outdoor	Outdoor-physical
Mathematics, physical science	Sciences	Science	Mathematics, physical science
Biological science	—	—	Biological sciences
Humanities	Cultural	General cultural	Humanistic
Arts	Arts and entertainment	Arts and entertainment	Arts

We have chosen the 1956 version because it is the only one that contains hints of a structural relationship so that it afforded the best classification for our purposes.

CHAPTER FIVE: INTERESTS

As stated, we set out to find out a structure of occupations by interests.

A long list of publications on interests, their stability as such and their connections with vocational choice, job satisfaction, persistence in work, scholastic achievements, values and aptitudes has been reviewed by Super and Crites (*Appraising Vocational Fitness*, 1962). There accordingly seems little point in a further theoretical discussion.

There are different ways of ascertaining a subject's vocational interests. He may be presented with a list or inventory of occupations and asked to rank his attitude to each, to choose one of several, or to answer questions on the items listed. There is no evidence that any of these methods is preferable to the others. The investigator's choice is usually determined by technical considerations. As will be seen in Chapter 7, the multiple choice method seemed best suited for our purposes.

We did not examine personal orientations within J.L. Holland's meaning (1963), by first trying to find out whether the respondents are realistic, intellectual, social, conventional, enterprising or artistic. Rather than establishing "model types", the existence of which seems rather doubtful, and basing the structure of occupations on their inferred overall interests, we used the more direct method of establishing the subjects' (eighth graders') overt occupational interests on the basis of an inventory of occupations. It seemed to us that this approach, not based on model types, would be more realistic and would correspond more closely to the variegated nature of occupations and of human beings about to select a career.

Overt interest may well be influenced by the example or advice of parents and friends, but then so are the careers of many people. The very fact that the advice has been accepted is indicative. It is not intended in this study—which is designed to assist the vocational counsellor—to probe deeper into the individual's personality structure and motives than is warranted in order to provide the necessary counselling. The respondents might have been directed by their parents or friends to respond favourably to all occupations referring to art or to science, for instance. But this is precisely what we wanted to find out.

All classifications of occupational interests designed for vocational guidance purposes are based on the underlying assumption that if the subject's aptitudes and interests both lie in a certain direction his chances of success are much greater than if only his aptitudes lie in that direction, but not his interests.

The field of aptitudes has been amply covered by research. It is now possible to test both general intelligence and specific aptitudes for practically any area of human activity. However, the situation is less clear with respect to interests, although a number of U.S. studies have shown their correlation with achievement and success. Strong (1943), for instance, in an immense longitudinal research project, has investigated a huge population to test the correspondence between interests and occupational choice, and found valid relationships for this specific population which are probably applicable to the entire United States. Still, there is a considerable

difficulty in transferring these findings to other cultures and societies. Poorer and less developed countries have neither the means nor the population for similar studies. A structure of occupations by interests would therefore no doubt be very useful, as a basis for more limited studies—regional, cultural, etc.—to ascertain the specific relations between interests and vocational choice.

PART TWO: *Design*

CHAPTER SIX: HYPOTHESES

1. ROE'S HYPOTHESIS

A research hypothesis has two objectives: to serve as a guide in data collection and inference, and to avoid the need for trial and error; for by the trial and error method apparently significant results may sometimes be the random product of the large number of tests performed.

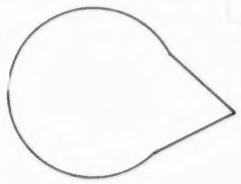
In the present study the underlying hypothesis served as an initial guide for testing the structure of occupations by interests. The search for the right structure was aided by drawing up a list of possible alternatives which contradict this hypothesis and might apply in case it is rejected. The underlying hypothesis is:

On classifying the occupations into fields and levels, according to Roe, and examining the occupational interests, a graded order of levels in each field, and a circular, single-deviational structure of fields in each level, are obtained from the correlations found.

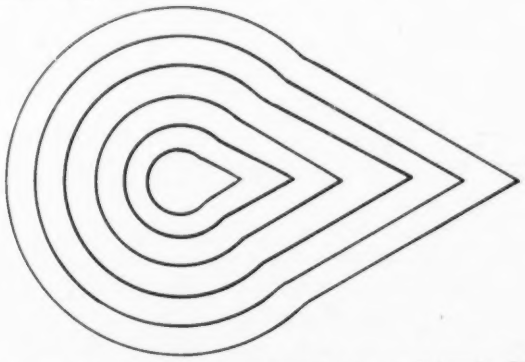
The research hypothesis presumes that the fields and levels are arranged as suggested by Roe, viz.:

> ". . . contiguous cells are related. Levels are arranged in hierarchical order, with Level 1 at the top and each successive Level requiring less skill and/or training and involving less responsibility. Groups are so arranged that, with one exception, contiguous ones are more closely related than noncontiguous ones. Each of Groups IV, V and VI is related to the other two to about the same degree. Group V, placed between IV and VI, obscures the close relationship between these two. The Groups are arranged in this order because IV is also related to III and VI to VII, whereas V is less closely related to any of the others. The arrangement should be thought of as circular, that is, Group VIII is related to Group I as well as to Group VII" (1956, pp. 144–145).

The graphic representation of the fields at any one level would thus be as follows:



and of all levels taken together



The hypothesis stipulates the existence of all fields at all levels. There is no good reason why this should or should not be so, but it is a convenient starting point.

In statistical terms of correlations, Roe's hypothesis implies a *simplex* structure of levels in each field, i.e., a graded order of correlations, and a *circumplex* structure between the fields in each level, i.e., a circular arrangement of correlations.

For the benefit of readers who are not familiar with these concepts, let us illustrate them.

A simplex structure: If we compute all the possible intercorrelations between the height of a group of boys in the ages of 4, 6, 10 and 13, for instance, we will find that the highest correlations are those between the ages 4 and 6, 6 and 10, and 10 and 13. This is due to the continuous growth pattern at these ages. The correlations between the ages of 4 and 10 and of 6 and 13 are lower; still lower is the correlation between the ages of 4 and 13. Accordingly we have the following order of intercorrelations:

ILLUSTRATION OF A SIMPLEX STRUCTURE

Age	4	6	10	13
4	1.0	high	lower	low
6	high	1.0	high	lower
10	lower	high	1.0	high
13	low	lower	high	1.0

The following intercorrelations fit this simplex structure:

Age	4	6	10	13
4	1.0	0.9	0.7	0.3
6	0.9	1.0	0.8	0.4
10	0.7	0.8	1.0	0.6
13	0.3	0.4	0.6	1.0

A circumplex structure: How fast can a man run? Obviously, everyone runs relatively slowly when he is young and when he becomes old, and faster in the intermediate ages. In terms of correlations this means that there are high correlations between speed measurements in similar age groups and also between the younger and older age groups and that the correlations between the younger and intermediate age groups and between the older and intermediate age groups are lower. The following correlations would fit this idea.

ILLUSTRATION OF A CIRCUMPLEX STRUCTURE

Age	10	12	20	25	50	60
10	1.00	.90	.60	.40	.50	.70
12	.90	1.00	.65	.45	.42	.65
20	.60	.65	1.00	.80	.30	.20
25	.40	.45	.80	1.00	.35	.38
50	.50	.42	.30	.35	1.00	.85
60	.70	.65	.20	.38	.85	1.00

In the diagonal (i.e. when the correlation is between each of the age groups with itself) the correlations must be 1.00. It is seen that in such a circumplex structure the correlations next to the diagonal are higher than those further removed from it. (For further explanations of these terms see Jones, 1960, or Guttman, 1954 and 1955.)

A simplex structure in one dimension and circumplex structure in another is called a *radex* structure. However, using the terms "circumplex and "radex" means to ignore the deviation of the fifth field, for Outdoor fails to form the intermediate step between Technology—the fourth field—and Science—the sixth field. While these fields are spaced out on the circumference of a circle, Outdoor is presumed to lie at a point about equidistant from both, outside the circle.

It can hardly be expected that a graded order may be found in each field and that the circular structure of the fields should be without deviations at all levels. Even in a fairly small number of well-defined sectors a deviationless structure is unlikely to be found. According to Guttman, when there is a large number of undefined sectors numerous deviations are liable to occur. The expected structure would thus be a quasi-simplex in each field, and a quasi-circumplex at each level.

Roe provides no empirical basis in support of the structure suggested by her, nor is it clear from her book what kind of empirical evidence would be required for this purpose: job analysis or analysis of interests, or content analysis of occupational descriptions, etc. This study, however, is not designed to examine whether Roe is right or not. Her claims can be disproven only by a series of studies of this kind on different age groups, members of different occupations, experts in occupational classification or job analysis, different sexes, cultures, etc. Our object was merely to investigate whether Roe's system can be used as an instrument for giving

vocational guidance to school leavers in Israel. Moreover, we arbitrarily assumed in our hypothesis that the structure of occupations suggested by Roe was a structure of occupations by interests. We are thus not directly concerned with Roe's theories. Her structure might well coincide, for instance, with the accepted image of occupations formed by job analysts or by members of various professions or occupations, but whether to their mind General Cultural is really closer to Science than to Technology, for instance, does not seem to be essential for vocational guidance so that a ramified investigation proving or disproving all facts of her structure seems fairly pointless. What does seem important is the image shared by those about to choose a certain occupation and due to undergo vocational guidance.

The classification of occupations by levels and fields made by psychologists, vocational guidance counsellors, and the like reflects their idea of the proper relationship between the various occupations. The eighth graders examined, on the other hand, simply indicated the degree of interest they have in different occupations. It is postulated that also from their choice a certain structure is bound to emerge. Their image of the occupational world need not necessarily coincide with that of the experts in the field. It is, however, of primary practical importance because it provides the only means for evaluating the youngsters' aspirations, while the structure set up by the experts—whatever scientific value might be attached to it—can certainly not serve as a basis for the classification of occupations by interests. Though probably more impartial, their judgment is based on totally different criteria.

2. ALTERNATIVES CONTRADICTORY TO ROE'S HYPOTHESIS

The hypothesis according to Roe states that:

(a_1) there is a graded order of levels in each field, and that
(b_1) all fields are included in a single structure which follows a certain arrangement—circular, with one deviation (Outdoor).

The reserve of (a_1) is that there is no graded order of levels in all fields (a_2). The reserve of (b_1) is that either all the fields follow one single structure which is different from that suggested by Roe (b_2), or that the fields constitute more than one structure (b_3), or that there is no structure at all (b_4).

A graded order of levels was presumed to exist if the intercorrelations appear in the expected order in all fields, or if the same interchange of levels in each field results in such order.

The existence of a single structure of all fields (b_1) or (b_2) would be disproven if it were found that no structure of occupations comprises all without numerous or regular deviations in the intercorrelations. If no structure of occupations comprising four fields or more is found (b_4) will be adopted, meaning that there is no structure at all. The minimum number of four fields was taken because there is a high probability of a structure consisting of three elements recurring in two replications.

Thus, the probability of finding a circular structure of three elements recurring in two replications is $0.33^2 = 0.11$. On the other hand the probability of finding a structure consisting of four elements which would recur in two replications is less than 0.05.

In case the intercorrelations would have the appropriate structure, without regular or numerous deviations, the fields were presumed to follow the arrangement suggested by Roe.

There are seven alternatives contradictory to the hypothesis:

a_1b_2 There is a graded order of levels in all fields and the fields have one structure, but it does not conform to the arrangement suggested by Roe, following a different arrangement (not necessarily circular).

a_1b_3 There is a graded order of levels in all fields but the fields have more than one structure, each comprising some of the fields (some or all of the structures not being necessarily circular, or mutually exclusive).

a_1b_4 There is a graded order of levels in all fields but no structure of fields (either of all or of a number of them).

a_2b_1 There is no graded order of levels in all fields but the fields have a single structure, as suggested by Roe, in at least one level.

a_2b_1 There is no graded order of levels in all fields but the fields have a single structure, but not as suggested by Roe (and not necessarily circular).

a_2b_3 There is no graded order of levels in all fields and the fields have more than one structure, each comprising some of them (without any or all of the structures being necessarily circular or mutually exclusive).

a_2b_4 There is no graded order of levels in each field and no structure of fields —either one or several.

Since according to Roe the fields are arranged in a single structure, it is clear that if the number of structures is other than one, the arrangement cannot conform to Roe's contention.

The following diagram may serve to illustrate the above alternatives:

THE HYPOTHESIS AND THE CONTRADICTORY ALTERNATIVES

Structure of fields	*Level*	
	a_1 *Graded order*	a_2 *No graded order*
b_1: One according to Roe	a_1b_1 (hypothesis)	a_2b_1
b_2: One, not according to Roe	a_1b_2	a_2b_2
b_3: More than one	a_1b_3	a_2b_3
b_4: Non-existent	a_1b_4	a_2b_4

CHAPTER SEVEN: METHOD

The design of this study is somewhat more complex than is usually the case. It was therefore decided to present a general outline of the design. The reader who is not interested in further particulars may proceed after the first section directly to Chapter 9, for the index of the code used in the results presented in Part IV. Those interested in a further description of the planning and execution of this project may find the necessary information in the intervening sections. In order to satisfy both types of readers—those mainly interested in the findings and those also interested in the details of the design and procedure—a certain amount of repetition was unavoidable.

I. GENERAL OUTLINE

Over a thousand Israeli boys aged 13–14, attending the last year of elementary school, were divided into three samples. Every sample was given one of three interest questionnaires, each containing about 100 names of occupations. Two counsellors classified the occupations into fields and levels according to Roe's system. Occupations listed in one questionnaire were not included in any of the others unless not enough different occupations were found for at least three to be represented in every questionnaire for each level and field. The occupations were divided among the three questionnaire sets by a matching procedure, and presented in random order.

The respondents were asked to indicate their attitude to the occupations listed by marking each with the letters "Y" or "N", respectively, for those that interested or failed to interest them, or with the notation "?" for occupations on which they had difficulty in making up their minds. The reaction of every respondent to each cluster of occupations of the same field and level was appropriately scored. In each sample of test subjects, Pearson correlations were computed for all possible pairs of scores.

The hypothesis was tested in two stages. In the first stage Roe's contention as to the existence of a graded order of levels in each field was examined. If correct, a simplex structure of correlations should be found from the highest through to the lowest level. Thus, if the levels are arranged in the suggested order, the intercorrelation should be higher the closer the levels are to one another. The test was performed separately for each sample. The hypothesis would be confirmed if a simplex structure with no constant or numerous deviations were found in all three questionnaires. It would have to be rejected if constant deviations were found even after the order of the clusters had been changed in all fields in the same fashion.

In the second stage Roe's contention concerning the arrangement of the fields was examined. In case her presumption is correct, a circumplex structure of correlations without constant deviations should be found. Thus, if the fields are arranged in the resumed order, the intercorrelations between the clusters of contiguous fields

of the same level should be higher than between non-contiguous fields of the same level. The arrangement should be circular so that the eighth field should again be contiguous to the first. The one deviation permitted would be that the fifth field —outdoor—need not be interposed between the fourth and the sixth field.

The hypothesis would be admissible if the order of correlations between the fields at each separate level and in each sample conformed to the structure suggested by her. It would be disproven if constant deviations were found in all three samples. Similarly it would have to be discarded if no circular arrangement were found because, though not constant, the deviations would be too numerous.

2. POPULATION

a. Reasons for the Choice of the Population Selected

This study is designed to find a structure of occupations by interests. It is directly geared to the needs of vocational guidance for which such a structure would be most helpful. In need of vocational guidance are mainly young people finishing elementary school—youngsters between the ages of 13–14. This therefore was the population chosen for our study.

It might be argued that the interests of an older, working population are more stable and that they are more familiar with the world of occupations. Most probably, however, they are familiar only with their own and with allied occupations. What is more—they need no vocational guidance. Nor do those who are really and truly acquainted with all occupations—job analysts or vocational counsellors.

Boys about to finish elementary school are at a stage where they are due to make their first choice concerning their future career. Even if their interests are unstable and they have but scanty knowledge of the occupations they are about to choose, the choice is theirs, and they are bound to make it. Vocational counselling has to be based on that image, however faulty it may be in point of fact.

b. The Appropriate Population in Israel

Under the present system in Israel elementary school attendance for a period of eight years is compulsory for everybody. On completion of elementary school, usually at the age of 13–14, the graduates proceed to different types of post-elementary schools or go out to work. The last grade of elementary school comprises the highest age group which has not yet embarked on any definite course towards the materialization of its interests in any given occupation. Before the end of the school year many pupils are still torn between a variety of possible alternatives and their interests have not yet found concrete expression. Since their future orientation is a natural source of preoccupation, it is easy to obtain their readiness to answer an interest questionnaire. The subjects selected for this investigation therefore were Jewish pupils attending the last year of elementary schools in Israel.

c. Restriction of the Study to Boys Only

As may be seen from the design of the study, both its methodology and execution are highly complex. It was accordingly found advisable to restrict it to boys only. As a result no generalization may be made from it concerning the structure of occupations by interests among girls, without first conducting a parallel investigation of girls. The methods and results of the present study may well induce other investigators to investigate the structure of occupations along the same lines also among girls.

d. Sample Size

The hypotheses were to be tested by the order of the correlations found. This means that the relative size of each correlation is to be compared to the size of other correlations, and that the actual size of the correlation which is determinant in other studies is of no interest here. Hence it does not matter whether or not a given correlation is significant at a given certainty level.

Every correlation has a certain standard deviation. To find this standard deviation the correlation has to be transformed into z values, when the standard deviation is $1/\sqrt{n-3}$, where n is the number of cases for which the correlation was computed. Accordingly, sample size alone determines to what extent the correlation found may differ from the corresponding parameters. For a standard deviation of less than 0.01 a sample of 10,003 boys must accordingly be examined, but since this is not practicable, such a degree of accuracy cannot be attained. Instead of using one sample of 10,003, three separate samples were therefore used. The extra two samples may be expected to provide additional information which to some extent might compensate for the greater degree of certainty regarding the relative size of the correlations otherwise attainable.

In a sample of 500, the standard deviation is 0.045, and the 95 percent confidence interval is $r \pm 1.96 \cdot 0.045$ or $r \pm 0.09$. In a sample of 500 the probability of twice obtaining a deviation beyond the confidence interval in the same tail of the distribution is $0.05^2 \cdot \frac{1}{2} = 0.00125$ (see beginning of Chapter 10—estimation of random fluctuation of correlations). The chances of a deviation of this kind recurring in all three samples are minimal.

e. Description of Samples

It was intended that the three samples should comprise a total of 1,500 boys attending the last grade of elementary school, i.e., in the eighth year of compulsory education. Most of this pupil population belongs to the age group 13–14 with a small minority aged 14.5.

Boys from different localities—urban settlements, small towns and rural settlements—were selected for the three samples, so that the distribution by settlement should more or less correspond to the general distribution of the adult population of Israel. Since the proportion of young people in the rural and urban areas is not the same it was difficult to draw up exact statistics.

The boys selected attended different schools, some of which had a number of parallel classes. The 1,500 boys attended about 90 different classes. Some of the boys attended mixed classes, in which questionnaires were administered also to the girls but excluded from the data processing.

No selection was made by socio-economic status, IQ or similar variables since it was intended to gauge the interest structure of the overall population.

3. INSTRUMENTS

a. Questionnaire Form

The testing instrument was a questionnaire prepared in three parallel sets, each containing a list of over 100 occupations. Next to each occupation appeared the notations "Y" "?" "N" (the corresponding signs in Hebrew), of which one, and one only, was to be marked. "Y" denotes a positive attitude to the occupation; "N" denotes a negative attitude while "?" signifies that the respondent has difficulty in making up his mind. To prevent frustration in case of a respondent having an overt interest in an occupation not appearing in the list, he was given an opportunity to express his preference. At the end of the questionnaire space was provided for five additional occupations, headed by the remark: "Specify any additional occupations in which you would like to engage and which do not appear in the list." The occupations were listed one after the other in two columns on both pages of the questionnaire. In the top part of the questionnaire the respondent was required to enter his name and sex and to indicate the name of the school attended and of the locality where it is situated.

b. Number of Occupations in each Level and Field

Roe's classification, as well as other classification systems, comprise various categories of occupations, each containing a larger or smaller number of occupations. The level of skilled workers in the field of Technology, for instance, comprises a large number of occupations while the lower levels of Science and General Cultural include but a few.

When a category comprises a relatively small number of items, a few are sufficient to represent it properly. Obviously a category comprising a single occupation is adequately represented by that occupation. One occupation may also be adequate to represent a category even if it comprises a number of occupations, as long as there are not too many and the one selected has the characteristics typical of those occupations and none that are outstanding or irrelevant characteristics. The larger the number of occupations comprised within a category, the less one single occupation is apt to represent it adequately. If there are as many as several tens or hundreds, it is hardly possible for one occupation, however well chosen, to represent the entire category. Such a category is likely to be better represented by several occupations; in this way common characteristics are stressed and divergent characteristics pushed into the background.

By this line of reasoning the bigger the number of occupations listed the better the group is represented. This is especially so for the larger groups since the more occupations there are in a category the greater its intrinsic variety. Besides, there was a further reason for choosing more than a single occupation from each cluster. The response to a given occupation need not necessarily be indicative of the respondent's interest in the entire group of occupations in which it was included. An erroneous image or distractor qualities evoked by the name of a single occupation might bring about a reaction at variance with the respondent's real interest in the group of occupations concerned so that it cannot serve as a basis for determining the relationship between one category of occupations and another.

A wrong image held by a single respondent of the nature of a given occupation cannot affect the results, but with a sufficiently big number of respondents it is conceivable that the same misconception is shared by many of them. In the process of socialization various causes might lead to a stereotyped, incorrect image being formed in the minds of quite a number of boys. Many may think of a "farmer" as a person doing hard physical labour to earn his living "by the sweat of his brow", ignoring that mechanization has considerably changed the nature of the farmer's work. Solely increasing the sample therefore offers no solution to the problem of a stereotyped, erroneous image of various occupations held by a larger number of boys.

A twofold solution was found. In each of the questionnaire sets, different names of occupations were listed to the extent permitted by the number of occupations existing at each level and in each field. Secondly, it was decided as a general principle not to rely on the response to any single occupation, a minimum number of three occupations being considered necessary.

The counsellors, on making the necessary classification, could at their discretion include more than three occupations in certain levels and fields so that they might be properly represented. To avoid undue lengthening of the questionnaire, however, the maximum number of occupations for any category was set at eight.

By not placing reliance on a single answer a twofold purpose was achieved. On the one hand the counsellors were better able to provide adequate representation for each level and field in their classification, thus increasing the construct and content validity of the clusters. On the other hand it became possible, at least partially, to obviate errors arising from ignorance or misinformation about the occupations listed, from preferences based on considerations unrelated to field or level, or from any other causes; such errors can hardly be presumed to recur in respect of two or more occupations of a single cluster. The subject's degree of interest in a given cluster can only be assessed from his total response to the occupations representing such cluster.

Though care was taken properly to represent the image of the various clusters the number of occupations listed in the questionnaires for that purpose was not proportional to the number of occupations actually existing in each category.

No purpose is served by such proportional representation in the interpretation of the results, since the conclusions are drawn from the correlations found and no weighting is needed to compute these correlations. For proportional representation it would have been necessary to classify all existing occupations according to Roe's system, which is a highly complex operation since it would require a decision to be made in borderline cases where the classification is doubtful.

The same number of occupations was used in each cluster to represent the remaining occupations in the same field and level in all three sets of questionnaires. The following table shows the number of occupations in each cluster.

TABLE 2
NUMBER OF OCCUPATIONS, BY LEVEL AND FIELD

Level According to Roe	*Field*									
	Service	*Business*	*Organi-zation*	*Technol-ogy*	*Outdoor*	*Science*	*General Cultural*	*Arts & Entertain-ment*	*Total*	*Percent*
1 & 2*	3	3	3	3	3	4	4	4	27	23.1
3	3	3	3	4	3	3	4	3	26	22.2
4	4	3	3	8	4	3	3	3	31	26.5
5 & 6*	6	3	3	8	4	3	3	3	33	28.2
TOTAL	16	12	12	23	14	13	14	13	117	—
PERCENT	13.7	10.3	10.3	19.7	12.0	11.1	12.0	11.1	—	100.0

* See below (d) Reliability of levels and (e) Reduction of the number of levels.

c. How were the Occupations chosen for the Questionnaire

Every occupation included in the questionnaire had to be more or less familiar to youngsters in Israel. In respect of the more common occupations this involved no difficulty. The children had opportunities of seeing the craftsmen or professionals at work or of hearing about them. The difficulty arose in respect of the less common occupations which were therefore as far as possible excluded.

The choice of occupations to be included in the questionnaires was made as follows: the names of occupations cited by Roe (1956) on p. 151 and pp. 169–247 were translated into Hebrew. In case the occupation in question was familiar and easily classifiable it was included in the list and otherwise it was omitted. This resulted in the omission of a number of occupations such as YMCA secretaries—quite a rare occupation in Israel and certainly not familiar to boys aged 13–14. The resulting list was supplemented by the addition of common local occupations from the Occupational Classification 1961, drawn up on the basis of J. Hecht's Occupational Survey in Jerusalem (1963) and of official statistical publications.

The two counsellors checked Roe's classification with conditions prevailing in

Israel. Owing to cultural differences the classification of a given occupation in one place may not apply elsewhere. A nurse, for instance, may be a medical worker in one place and strictly belong to the service occupations in another.

The design of the study required that there should be at least three occupations of each level in each field. At certain levels in a number of fields this requirement was not fulfilled, as for instance in the lower levels of Business and of General Cultural (Roe left the corresponding clusters blank). Since otherwise the hypothesis could not be tested there was nothing for it but to add a number of rare occupations to the list, in those clusters where no three comon occupations could be found.

It appears that the prevailing image of some of these occupations was more or less correct, in spite of their rarity, e.g. of record librarian at the broadcasting service. In respect of other rare occupations a brief explanation was bracketed next to the name, e.g. composer (composer of music).

d. Reliability of Levels

An instrument of research must be sufficiently reliable. In this case the research instrument is the list of occupations classified by field and level, according to Roe. Accordingly, both the reliability of the expert classification by level and by field had to be examined. We shall here confine ourselves to the reliability of the level classification. The reliability of the field classification will be discussed in section (f) below.

"Reliability" here means inter-judge reliability. If a given occupation is classified by one counsellor as belonging to a certain level, it should also be similarly classified by the other. To ensure that the classification of all the occupations included in the three questionnaire sets are reliable, occupations on which no agreement is reached should accordingly be eliminated.

If it turns out that the counsellors cannot agree on the level of a large number of occupations it is a sign that the definition of the levels is unsatisfactory. It is then advisable to change the definitions of the levels and to reexamine the degree of consensus according to the new definitions.

e. Reduction of the Number of Levels

Two counsellors made an independent classification of occupations into six levels, using Roe's definitions (Chapter 4). On comparison, immediate agreement was found in respect of the level of close to 35 percent of the occupations classified. Most of the occupations on which no immediate agreement was reached were variously classified as belonging to levels 1 and 2 or 5 and 6.

The lack of consensus regarding these particular levels may be due to the peculiar structure of Israel's young economy, where the higher and lower levels are not yet sufficiently differentiated to distinguish between professional and managerial grade I and II and between a semi-skilled and unskilled grade. It was accordingly decided to combine levels 1 and 2 into one top level, to leave levels 3 and 4 as in Roe's

classification, and again to combine the bottom levels 5 and 6. Under this reclassification immediate agreement was reached on 87 percent of occupations. Subsequent discussion led to practically full consensus except on a few occupations which were discarded from all questionnaire sets. A third counsellor was consulted to approve decisions which were not the result of immediate agreement.

By combining levels 1 and 2 and levels 5 and 6 of Roe's classification, four levels were obtained. The occupations included in the questionnaires were therefore classified into four levels with the full consensus of both counsellors, as follows:

Level 1: Professional and managerial
(Levels 1 and 2 of Roe)
Level 2: Semi-professional and small business
(Level 3 of Roe)
Level 3: Skilled
(Level 4 of Roe)
Level 4: Semi-skilled and unskilled
(Levels 5 and 6 of Roe).

Henceforth we shall therefore refer to levels 1–4. There remain eight fields, with four levels each—a total of 32 sectors or clusters, each represented by several names of occupations.

The research hypothesis stipulated a graded order of levels. In case such order exists, it may be arbitrarily divided into any number of divisions provided the level in each division remains homogeneous. In our case homogeneity of occupations in each level meant a maximum of four levels.

f. Reliability of the Classification by Fields

The problems encountered here are similar to those met with in the classification by levels. Again agreement is required between the classifying experts. Since both counsellors were acquainted with Roe's system and had already used it on various occasions, it was not surprising to find immediate agreement in 96 percent of the occupations. After some discussion, the field of additional occupations was also agreed upon. Occupations on which no consensus was reached were discarded. A third counsellor was consulted on all occupations on which no immediate agreement was attained, and whenever the decision reached by discussion was not approved the occupation was eliminated.

As stated, the counsellors were supposed to find at least three occupations for each level and field, and when they did not immediately find sufficient occupations for a given cluster they discussed the matter among themselves. These discussions were not recorded and it is not known which occupations they discarded until they found occupations they could all agree upon. As a result the rate of consensus may appear to be higher than it actually was at the outset.

There is, however, one difference between the reliability of the classification

by level and by field. Level is defined by level of education, responsibility, experience, ability, etc., each of these forming a continuous scale so that presumably a combination of several criteria also forms a continuum. The working hypothesis states that the interests in the different levels are also arranged in a continuous graded order, as are the levels themselves, the division into a number of levels forming cutting points along a continuum. Hence occupations which lie near the sectional points are not clearly distinguished from the contiguous occupations on the other side of the sectional point on the continuum. The classification of these occupations is rather doubtful.

This does not apply to the fields, which form no continuum except by hypothesis. They are defined by characteristics, none of which constitutes a continuum. The classification by fields is determined by qualitative categories which are not one-dimensional. There are no borderline cases, as on a continuum, and it is therefore easier to reach consensus in this respect. In fact there was a much higher rate of agreement in the field classification than in the classification by levels.

Immediate agreement on both field and level was reached in 83.5 percent of occupations. Only those names of occupations were included in the questionnaires on which there were no differences of opinions regarding either level or field.

g. Homogeneity of Occupations in each Level and Field

The respondent's interest in occupations of a given level and field was measured by his response to 3–8 different occupations. Here the question arises to what extent these occupations are related to each other, so as to be put under the same heading. If the images evoked by the names of occupations represented in one such cluster are unrelated, the total cluster score can hardly be considered representative of the respondent's interest in this group of occupations. According to the classification method described, the occupations may be considered homogeneous from the theoretical point of view, but this does not yet guarantee that the respondents also regard them as such. A sufficiently large degree of correspondence is required between the respondents' reactions to the different elements of each cluster. One way of establishing this is by means of intra-correlations.

The intra-correlations need not be high—although they may well turn out to be so—because as set out in (b) above, each cluster was represented by several occupations of the same level and field. This is sufficient to avoid misrepresentation of the cluster or over-reliance on responses based on erroneous assumptions. On the other hand it cannot prevent a mistaken response to some of the occupations representing the cluster, due to various misunderstandings, and here the intra-correlation check seems indicated. For clusters represented by only three occupations there was little point in computing intra-correlations. This would mean a comparison between two occupations and a single occupation and, as stated, no reliance whatsoever can be placed on any single occupation. It is worthwhile to compute intra-correlations only for clusters containing at least four occupations, of which there

were a total of 11. In the corresponding table an attempt was made to match the occupations on a half and half basis. Of course neither half properly represents all the occupations comprised in the respective field and level; the counsellors had good reason to co-opt another 1–5 occupations to the cluster to provide full representation, seeing that three occupations would not be sufficient. The splitting up involved in the computation therefore implies a change in the nature of the cluster. Accordingly, the 2–4 occupations comprised in half the cluster do not sufficiently represent the total number of occupations of the respective field and level, so that the intra-correlations corrected according to the Spearman-Brown Formula provide no full reliability check. "The Spearman-Brown formula . . . assumes that when we change the length of the test we do not change its nature." (Cronbach, 1960, p. 130). Though the matching may seem rather arbitrary, a reliability check was nevertheless carried out and the intra-correlations were corrected according to the Spearman-Brown Prophesy Formula. The results present the lower limit of reliability. No definite conclusions may be drawn from this on the response reliability of those clusters for which no check was made. The computations were made on 100 questionnaires selected at random from set C, and showed the following results:

TABLE 3

INTRA-CORRELATIONS BETWEEN OCCUPATIONS IN CLUSTERS REPRESENTED BY AT LEAST 4 OCCUPATIONS (100 QUESTIONNAIRES OF SET C)

Field	*Level*	*Occupations matched by Intra-correlations*		*Intra-correlation*	*Reliability corrected according to Spearman-Brown*
		Occupations	*Occupations*		
Service	3	Male hospital nurse Confectioner (pastry work)	Air hostess Soldier (regular army)	.333	.500
	4	Supernumerary policeman (guard of public buildings) Cook School janitor	Bus ticket collector Hotel chambermaid Porter	.450	.621
Technology	2	Radio technician Aircraft pilot	Owner of workshop Draftsman (technical drawing)	.483	.651
	3	Builder Lithographer (for printing of pictures) Motor car electrician Mechanical knitter	Turner (working on lathe) Structural metal worker Dressmaker Diamond-polisher	.522	.686

TABLE 3 (continued)

	4	Baker Ironer (clothes pressing)	Wood polisher Tyre repairman Factory worker	.452	.623
		Driver of steamroller House painter	Straw and bast weaver		
Outdoor	3	Farmer Sailor	Fisher Miner (minerals)	.646	.785
	4	Quarryman (stone) Shepherd	Tractor driver Afforestation worker	.521	.685
Science	1	Physician	Theatre nurse (surgical)		
		Chemist	University professor in natural sciences	.585	.738
General Cultural	1	University professor in humanities Judge	Publisher (of books) Secondary school teacher	.626	.770
	2	Tourist guide Handicrafts teacher	Elementary school teacher Nursery school teacher	.351	.520
Arts & Entertainment	1	Stage director Poet	Composer (of music) Curator of museum (art and antiquities)	.616	.762

The reliability coefficients can be considered quite high. It may be argued that they are not corrected for the general positive or negative attitude of respondents to any occupation. To find a suitable base line the following method was used.

Twenty occupations were chosen at random, and divided into five random clusters of four occupations, each of which were then divided at random into two pairs each. The intra-correlation between the pairs in each random cluster was calculated. The results are shown in the following table.

TABLE 4

INTERCORRELATIONS OF RANDOM PAIRS OF OCCUPATIONS IN RANDOM CLUSTERS (100 QUESTIONNAIRES OF SET C).*

Occupations matched by intra-correlations		*Intra-correlation*	*Reliability corrected according to Spearman-Brown*
Occupations	*Occupations*		
Ritual Scribe (writer of Torah scrolls and Mezuzot) (VII, 3)	Stage director (VIII, 1)	0.142	0.249
Pedicurist (treatment of feet) (VI, 3)	Tourist guide (VII, 2)		
Salesman (II, 3)	Cook (I, 4)	0.165	0.283
Trade union secretary (III, 2)	Salesman in kiosk (II, 4)		
Fisher (V, 3)	Filing clerk (III, 4)	0.105	0.190
Laboratory worker (VI, 2)	Handicrafts teacher (VII, 2)		
Chemist (VI, 1)	Milkman (II, 4)	0.328	0.494
School janitor (I, 4)	Stage worker (stage helper) (VIII, 4)		
Mechanical knitter (IV, 3)	Laboratory worker (VI, 2)	0.292	0.452
Tourist guide (VII, 2)	Diamond polisher (IV, 3)		

* Fields designated by Roman numerals, levels by Arabic numerals.

The mean (after transformation to z scores) corrected for reliability by the Spearman-Brown formula is 0.336.

All correlations in the true clusters are higher than in the random clusters. When relatively high correlations were found, the occupations selected at random were either of the same field or level. In the last correlation, for instance, both pairs include an occupation of the same level and field.

An alternative empirical method of checking the reliability of the classifications is offered by the set of replications used. If the order of levels and fields is maintained throughout even when some of the occupations are replaced by others, the criteria determining the classifications are evidently sufficient. If a constant order is found in all three replications this may be regarded as evidence of the classification carried out by the counsellors having resulted in homogeneous groups.

This empirical test must in any case be carried out in order to draw any valid conclusions as to the existence of a structure of occupations. Lack of similarity between the occupations included in the clusters might be one of the reasons for not finding such a constant structure and then reclassification according to better definitions and criteria would be called for.

h. Construction of Three Questionnaire Sets

The list of occupations on the classification of which the counsellors were in full agreement, comprised 274 names. They now had to be divided into three sets, with at least three occupations of every level and field in each set.

This was done by way of matching, carried out by the same counsellors who did the classification. The task of matching was not always easy. When a complete match between all three sets was unattainable, preference was given to set C. In several instances when the number of occupations was not enough for different ones to be included in each of the three sets, care was taken that sets B and C should be different while the same occupations were inserted in sets C and A. As a result set C is the best set, and set B the better replication. In some clusters there were not enough different occupations even for two sets, and the names of one or several occupations were repeated in all three.

Three out of thirty two clusters were represented by the same occupations in all three sets. In 11 clusters, the counsellors did not consider three occupations to be sufficiently representative, and included 4–8 occupations. The general average per cluster was 3.7 occupations.

On the one hand the best possible representation of the clusters was aimed at, which sometimes involved the inclusion of additional occupations. On the other hand care had to be taken not to present the subjects with too long a list. The net result of reconciling these contradictory trends was that 117 occupations were included in each questionnaire.

At this point it might seem indicated to specify the occupations comprised in each set so that the reader may judge for himself to what extent the conclusions of this investigation depend on the classification and be able to translate levels and fields into terms of actual occupations. Although the transfer between one culture and another is more easily accomplished for groups of occupations than for single occupations, the definition of the fields and levels alone hardly presents a full picture. This purpose seems to be adequately served by presenting the occupations included in the three questionnaire sets in Appendix B.

At first sight the classification of some of the occupations may seem rather surprising. It might be worth while to discuss one of these instances, such as the classification of graduate nurse in level 1 of Service and midwife in level 2. It might seem that a midwife belongs to a higher level than a graduate nurse. To become a midwife it is necessary first to pass a three years nursing course, after 11–12 years of general education, and then to take another half-year course in midwifery. However, in view of the shortage of candidates in Israel, admission to the midwifery course was also granted to practical nurses with only 8–9 years of general education and a year and a half of general nursing. As a result most graduate nurses have a higher level than most midwives. (The rules of admission were recently modified and the respective levels might change in the future.)

i. The Order of Occupations in the Questionnaires

The 117 occupations in each questionnaire were divided over two pages with 57–60 on each page. To facilitate scoring, clusters were not scattered over both pages.

Since the effect on the subject of the appearance of an occupation at the beginning or at the end of the list was unknown, the clusters were divided over both pages as follows: in sets C and A, level 1 and 3 occupations in Service, Organization, Outdoor and General-Cultural and level 2 and 4 occupations in Business, Technology, Science, Arts and Entertainment, were printed on the first page. All the others were printed on the second page. In set B the order was reversed. The occupations were arranged in two columns on each page. Occupations with long names were moved to the bottom of the appropriate page. The rest were arranged at random. The frequently used system of arranging items by alphabetical order could not be employed because the distribuation of the Hebrew names of occupations over the letters of the alphabet cannot be considered random: in Service 20 percent of occupations in the three sets begin with the letter M; in Business—42 percent; in Organization 39 percent; in Technology 20 percent; in Outdoor—29 percent; in Science—5 percent; in General Cultural—45 percent; and in Arts and Entertainmant 31 percent.

The following table illustrates the division of occupations between the two pages of the questionnaire.

TABLE 5

DIVISION OF OCCUPATIONS BETWEEN TWO PAGES OF TEST QUESTIONNAIRES

Level	*Field*							
	Service	*Business*	*Organi-zation*	*Technol-ogy*	*Outdoor*	*Science*	*General Cultural*	*Arts & Entertain-ment*
1	P	Q	P	Q	P	Q	P	Q
2	Q	P	Q	P	Q	P	Q	P
3	P	Q	P	Q	P	Q	P	Q
4	Q	P	Q	P	Q	P	Q	P

P denotes first page in sets C and A and second page in set B.
Q denotes first page in set B and second page in sets C and A.

j. Scoring of Reactions

In the analysis of the results, Y (Yes) scored two, ? (Doubtful) one and N (No) zero. This presumes the existence of a continuum between Y and N, with ? lying in between, a frequent assumption in many studies and questionnaires (e.g. Stouffer, 1950). In this way the respondent ranks his attitude to each occupation according to the degree of attraction it holds for him. However, it is the respondent's personal ranking, and identical reactions do not have the same significance. With one, a slightly

favourable attitude towards a given occupation might lead to a response Y, while with another the same attitude might lead to a response of ? while still another respondent may put down N. According to the instructions issued, "?" is supposed to indicate the respondent's difficulty to decide whether his attitude is positive or negative. In certain questionnaires, such as the one used by Kuder, the intermediate mark between Y and N is I, meaning "indifferent". The use of ?, denoting difficulty to make up one's mind, seems preferable because when faced with an occupation in which the respondent is unlikely to engage the temptation to put down "indifferent" might be greater than to indicate that he is unable to make up his mind.

Scoring only the positive reactions would lead to loss of information, as found by Strong in his study on the SVIB questionnaire.

PART THREE: *Procedure*

CHAPTER EIGHT: DATA COLLECTION

1. THE SAMPLE

The sample tested consisted of 1,114 Israeli boys in the second trimester of their eighth year of schooling (the last year of elementary school). Most of them were between the ages of 13 and 14; less than one percent were under 13 years and about 6 percent were between the ages of 14 and $14\frac{1}{2}$. They attended about 80 different, mostly mixed, classes in Israel. Some 80 percent lived in major towns (nearly 60 percent of the total in Jerusalem), 13 percent in smaller towns and 7 percent in other localities.

Other studies conducted on the same sample have shown that the distribution of aptitudes was very similar to that of the Jewish population of Israel as a whole. Regarding the socio-economic distribution, no sufficient information was available, but from the existing data it seems that the sample had a slightly higher standard than the population at large. Roughly 20 percent of the subjects were from schools frequently labelled as "poor", and about 30 percent were from reputedly good schools.

According to the original design of this study three samples of about 500 boys each were to be tested. However, because of the need to change the questionnaire instructions (see following section) after the preliminary testing of some 400 boys, two of the projected samples were cut down to about 300 each. The final results were calculated on 503 boys (45 percent) who answered the set C questionnaire, 321 boys (29 percent) who answered set B, and 290 (26 percent) who answered set A.

2. ADMINISTRATION OF QUESTIONNAIRE

a. Training of Testers and Pilot Test

There were eight testers who each presented the questionnaire to several groups of about 20–30 respondents, including girls in mixed classes. The testers were previously trained at the Hadassah Vocational Guidance Institute in Jerusalem in testing procedures and the presentation of questionnaires.

The questionnaire was first presented to about 400 subjects who were asked to mark every occupation they would like to engage in with a Y, every occupation they did not want to engage in with an N, and every occupation about which they were doubtful as to whether they would wish to engage in it with a question mark. It was found that the vast majority tended to mark practically all occupations with an "N".

The instructions were accordingly changed in a way more conducive to eliciting a favourable response. The 400 respondents who had received the original instructions were not included in the data analysis, and their testing was regarded solely as a pilot study providing the testers with the necessary training.

In the course of the subsequent testing, checks were from time to time carried out to see whether the instructions were properly issued and whether no explanations were given by the testers which might affect the response.

b. Motivation of Subjects

The questionnaire was presented after a $2\frac{1}{2}$ hours battery of 11 tests designed to test the subjects' aptitude for post-elementary studies. It was presented by the same tester and the subjects were not told that it was intended for research only. Apparently all respondents thought that it formed an integral part of the whole battery of tests, so that their motivation for answering according to instructions was assured.

c. Questionnaire Instructions

After the pilot study the instructions were as follows:

"This is no test but a questionnaire. In a test there may be correct and incorrect replies. In a questionnaire everybody answers to his own liking. (The tester writes the signs Y ? N three times on the blackboard, in three lines.) You have before you a long list of occupations—not all occupations of course—each marked with three symbols: Y ? N. You are to answer in respect of every occupation in this list whether it appeals to you or not. Put a circle round Y (the tester illustrates this on the first line on the blackboard) if you like the occupation or are interested in it *in any way* (the words "in any way" are stressed). If you do not like the occupation, put a circle round N, which means "No" (blackboard illustration on the second line). If you cannot make up your mind, put a circle round ? (blackboard illustration on the third line). If there is an occupation you do not understand, cross it out, but *be careful* to read the explanation in brackets. Many of the occupations in the list are suitable both for boys and for girls, and both may reply Yes to any occupation that interests them, whether it is put in the masculine or in the feminine gender.
Read the list through carefully, think about every occupation, and reply one after the other, without skipping any.
Your time is not limited, but you had better work fast."

These instructions were issued by the tester while the respondents had the questionnaire lying open before them, but as in the case of all other tests they were requested to wait and first listen to the instructions.

Generally it took the respondents less than ten minutes to answer the question-

naire. A collective test of about 25 subjects, including the distribution of the questionnaires, the issuing of instructions and the collection of the completed forms, required about 15 minutes.

d. Division of Questionnaire Sets

There were three parallel questionnaire sets and at first it was decided to divide them equally between the respondents. It was, however, technically impossible to obtain another 1,500 test subjects over and above those included in the pilot test. Accordingly the number of questionnaires was doubled.

This means that for the pilot test, testers were issued questionnaires in the order C, B, A, C, B, . . . After it was decided to reduce the number of set B and A questionnaires proportionally, the questionnaires were arranged in the order C, B, C, A, C, B, . . . There was no known difference in aptitude level and socio-economic status between the pilot and regular test subjects. In outward appearance the different sets of questionnaires closely resembled one another. To avoid copying, every respondent sat at a separate table, so that the fact that not everybody had the same list of occupations was not noticed. Only after the questionnaires had been handed back and when the respondents had had an opportunity to exchange views among themselves they found out that they had not all been presented with the same list.

e. Special Problems

On rechecking the questionnaires two mistakes were found. The occupation "road labourer" appeared twice on both pages of set B, being classified by one of the counsellors under level 4 in Technology and by the second under the same level in Outdoor (according to the 4 grade division of the levels). In fact according to the project design this occupation should not have appeared in any questionnaire. In the analysis of the results it was of course not taken into account. The respondents who drew this set answered, as required, in the order of the list, and marked the occupation twice, in response 13 and 64. Only a few of them queried the double inclusion of this occupation (no exact record was kept). The rest probably did not notice it because of the rather long list of occupations and the random order in which they were presented, or otherwise they did not bother to raise the question. When asked, the testers requested the respondents to mark the occupation once again, and to go on marking the rest of the occupations in the order presented. None of the testers happened to notice any subjects who referred back to the first page to look up their initial response.

As it happens, there is some slight advantage to this mistake. The respondents' first reaction to the occupation "road labourer" may thus be compared with their second response. The same response was given by 312 out of 321 subjects (97.2 percent) of whom 309 answered in the negative. The high percentage may, however, have been affected by the general tendency to respond negatively to this occupation.

The second mistake occurred in set A, in the field Arts and Entertainment,

where an inappropriate occupation was included in level 3. The response was not taken into account in the analysis of the results, but consequently there were only two occupations left in this cluster instead of the required three.

As a result of these two mistakes, data for only 116 occupations were processed in both sets A and B, whereas in set C, where no mistakes occurred, the full number of 117 occupations could be analysed.

f. Inappropriate Answers

In addition to the 1,114 respondents included in the analysis of the results, there were another 18 who were eliminated because they had crossed out or skipped over 20 percent of the occupations listed. Eleven of these were new immigrants who had come to Israel the year before and apparently failed to understand the instructions or the Hebrew names of the occupations.

The following table shows the frequency of crossings out and omissions which occurred in spite of instructions to the contrary.

TABLE 6

NUMBER OF CROSSINGS OUT AND OMISSIONS, BY SETS

Frequency	*Set*					
	C		*B*		*A*	
	Number of Crossings out	*Number of Omissions*	*Number of Crossings out*	*Number of Omissions*	*Number of Crossings out*	*Number of Omissions*
0	328	431	225	257	182	202
1	67	40	33	40	36	45
2	46	18	24	12	18	24
3	34	8	14	3	17	8
4	16	3	10	4	8	7
5	5	1	4	2	7	1
6	2	—	2	1	5	—
7	1	—	3	—	2	2
8	2	1	—	—	2	—
9	—	—	1	1	3	1
10	1	—	1	—	2	—
11 +	1	1	4	1	8	—
TOTAL	503	503	321	321	290	290
As Percentage of Possible Number of Responses	0.7%	0.2%	0.8%	0.3%	0.5%	0.5%

On the average the subjects failed to supply about 1 percent of the required responses, so that in scoring about one percent of the items had to be made up by weighting according to the pattern of the remaining answers. Hence it may be concluded that the respondents themselves had the feeling that they understood the names of the occupations listed.

Fewer responses were obtained for certain occupations than for others. In set C, for instance, there was one subject out of 503 who did not understand the meaning of postal clerk and crossed out this occupation, but there were 45, or close to 9 percent, who failed to understand the meaning of occupational therapist and omitted to mark this item. A particularly high rate of omissions and crossings out in a given cluster obviously diminishes the value of its score. Despite the high response rate of 99 percent, it was therefore necessary to find out which particular occupations did not elicit a full response.

TABLE 7

OCCUPATIONS CROSSED OUT BY 5 PERCENT OR MORE OF SUBJECTS, BY QUESTIONNAIRE SET

Occupation	*Field*	*Level*	*Set C*		*Set B*		*Set A*	
			Frequency	%	*Frequency*	%	*Frequency*	%
Electronics mechanic	Technology	2	N.R.*	—	17	5.25	N.R.	
Fashion model (mannequin)	Arts & Entertainment	4	24	4.77	N.R.		22	7.59
Air hostess	Service	3	35	6.96	N.R.		N.R.	
X-ray technician	Science	2	31	6.16	N.R.		N.R.	
Afforestation expert	Outdoor	1	31	6.16	6	1.85	13	4.48
Manicurist (treatment of hands)	Service	4	N.R.		25	7.72	N.R.	
Massagist (treatment by massage)	Science	2	N.R.		N.R.		46	15.86
Ceramist (artistic pottery)	Arts & Entertainment	2	38	7.55	N.R.		N.R.	
Cosmetician	Service	2	N.R.		47	14.51	N.R.	
Shorthand writer	Organization	3	N.R.		N.R.		27	9.31
Occupational therapist	Service	1	45	8.95	N.R.		28	9.66
Seamstress—factory-work	Technology	4	N.R.		N.R.		26	8.97

*N.R.—Not Represented.

The only cluster of which two occupations appear in this table is Science, level 2, but they are not represented in the same questionnaire: X-ray technician appears in Set C, massagist in Set A. It is thus seen that the omissions do not occur in any particular cluster.

CHAPTER NINE: DATA ANALYSIS

1. SYMBOLS

The results of the investigation are presented in Part IV. To facilitate their presentation a series of symbols was used for fields and levels. The coding method is very simple. Every cluster showing a given level in a given field was given a number of two digits. The left digit indicates the serial number of the field according to Roe's order (eight fields) and the right one denotes the level (four levels). Thus cluster 11 indicates the field of Service at the highest level, cluster 62 indicates the sixth field —Science—at the second level, etc. The coding of the different clusters of occupations is shown in the following table:

Level	*Field*							
	Services	*Business*	*Organization*	*Technology*	*Outdoor*	*Science*	*General Cultural*	*Arts & Entertainment*
1	11	21	31	41	51	61	71	81
2	12	22	32	42	52	62	72	82
3	13	23	33	43	53	63	73	83
4	14	24	34	44	54	64	74	84

This table is reprinted on a separate card, as a constant reading aid (and as a bookmark).

2. THE SCORING SYSTEM

As stated in the part dealing with the design of the project, a score of two was given to response Y, of one to response ?, and of zero to reply N. Each subject was required to respond to 117 occupations listed in random order and constituting 32 clusters of occupations. The 117 occupations received a total of 32 scores—the product of the four levels multiplied by the eight fields.

In case an occupation was crossed out by the respondent (as required by the instructions if he failed to understand its meaning) or where contrary to the instructions he failed to respond to a given occupation, the score was given according to the remaining occupations of the cluster to which he did respond, and the score was proportionally weighted according to the number of missing responses. For instance, if the respondent marked only two out of three occupations included in a certain cluster, one with Y and one with N, he scored two points on these two occupations, and he was given a total score of three for this cluster as the estimated score for all three occupations if he had also marked the third. A similar weighting procedure was applied in case he marked only one occupation in a given cluster.

As stated, the number of occupations is not equal in all clusters. Twenty-one clusters are composed of 3 occupations each, and 11 consist of 4–8 occupations.

The difference in the number of occupations included in the various clusters does not affect the size of the correlations. For vocational guidance purposes, on the other hand, it is necessary to examine the scores indicating the subject's interest in the individual occupations comprised in the different clusters. The score in each cluster was therefore weighted so that the maximum score per cluster should be 24, and the minimum zero. Without this weighting there would be no reason why a score of 9 for a cluster requiring 8 reactions should be more than a score of 6 for a cluster requiring only three.

This weighting does not affect the structure of correlations between the occupations, as correlations are not changed by linear transformation. The weighting was done as follows:

The score of clusters containing 3 occupations was multiplied by 4
The score of clusters containing 4 occupations was multiplied by 3
The score of clusters containing 6 occupations was multiplied by 2
The score of clusters containing 8 occupations was multiplied by 1.5

In cluster 83 of set A where by mistake only two occupations were included, the number of points was multiplied by 6. Cluster 44 of set B contained 7 occupations and here the number of points was multiplied by 1.7. Fractions were rounded off.

The overall scoring of the questionnaire required on the average 3.5 minutes for all 32 scores (not including rest periods). In a sample of 70 questionnaires (2240 marks) 0.13% scoring errors were found.

3. COMPUTATION OF CORRELATIONS

In each set correlations were computed between all possible pairs of clusters. A total of $3\binom{32}{2}=1488$ correlations was calculated in the three sets. As stated, set C was administered to 503 subjects, set B to 321 and set A to 290. I.B.M. computers were used for the purpose of these calculations. From the following explanations it will be seen why the correlations between all possible pairs of clusters had to be calculated, and it was not enough to find intercorrelations between clusters either of the same field or of the same level.

PART FOUR: *Results*

CHAPTER TEN: TESTING ROE'S SUGGESTED STRUCTURE

1. ROE'S SUGGESTED STRUCTURE (RECAPITULATION)

Roe's contention consists of two parts, the one dealing with the structure of occupations in each field, and the second with the structure of the fields.

The occupations within each field are claimed to be arranged in a graded, descending order, from the highest to the lowest level. Roe divides the occupations into six levels in each field. As noted, it was found necessary to limit the number of levels in this study to four only.

The fields are supposed to be arranged in the following circular order: Service, Business, Organization, Technology, Outdoor, Science, General Cultural, Arts and Entertainment, Service . . . Outdoor is the alleged exception in that it is not interposed between Technology and Science.

In statistical terms Roe's suggested structure means that the correlations between the different occupations form a structure which resembles a radex. According to the first part of her contention there should be a simplex order in each field, and according to the second part the fields should be arranged in a circumplex structure with one deviation of the fifth field.

At first sight the two parts of Roe's supposed structure are independent of one another and it makes no difference which is examined first. In fact, however, there is a difference between them. While the first part is indeed independent of the second, the second is dependent on the first.

The first part of the contention relates to the order of levels in each field. This has nothing to do with the arrangement of the fields. It can even be tested without their being arranged in any manner whatsoever. The second part speaks of a circular arrangement of the fields. This requires some elucidation: at which level is this circular arrangement supposed to exist? There might be a circular arrangement of each level, of some of the levels, or of the summation of all levels. The widest interpretation would be a circular arrangement of each level. Whether this interpretation is accepted or not, it is, however, first necessary to examine whether the levels in the different fields are equivalent to one another. Even if the circular arrangement is taken to relate to the summation of all levels, weighting is necessary in view of the difference in the number of occupations comprised in each level. The weighting as such requires that the consistency of the levels in all fields be examined first.

In short, the simplex structure of the levels in each field has to be examined first and only then can the circumplex structure of the fields be tested.

Pearson correlations, when used to test the order of different terms of a series, are a highly sensitive instrument. The chances of obtaining exactly the same correlations in a number of replications are very slight. Sometimes the variations may be such as to require the rearrangement of certain clusters. Now the question is —when?

One way of distinguishing between random and non-random deviations is by calculating the standard deviation of the correlations after their transformation into z values. Providing for a certain confidence level, say, of 0.05, anything above 1.645 standard deviations is considered to be a significant deviation. This is the preferred method in studies not using replications.

A second alternative is to use replications. In this case only constant deviations are considered non-random, while the rest may be ascribed to chance in view of the sensitivity of the measurement. This was the method used in our study, but for the sake of verification and comparison the standard deviations of the z values of the correlations in the three questionnaire sets are also given below in this section.

A third method of distinguishing between true and random deviations is also available in our case. Since for some of the clusters it was impossible to find a sufficient number of different occupations the same occupations were used in all three questionnaire sets or in two of them. As there are a number of such clusters in each set, the size of the random deviations may be estimated from the fluctuation of correlations between identical clusters. The intercorrelations between identical clusters in the three questionnaire sets are presented in the following table.

TABLE 8

INTERCORRELATIONS BETWEEN IDENTICAL CLUSTERS

Clusters	*Set C z Value*	*Set B z Value*	*Set A z Value*	*Difference in z Values*
32 and 51	.354	n.i.*	.299	.055
32 and 52	.365	n.i.	.182	.183
32 and 63	.448	n.i.	.343	.105
32 and 64	.377	n.i.	.310	.067
32 and 84	.448	n.i.	.192	.256
51 and 52	.485	.618	.549	.133 .064 .069
51 and 63	.277	.288	.354	.011 .077 .066
51 and 64	.224	n.i.	.310	.086
51 and 84	.288	n.i.	.203	.085

TABLE 8 (continued)

Clusters	*Set C z Value*	*Set B z Value*	*Set A z Value*	*Difference in z Values*
52 and 63	.332	.267	.277	.065 .055 .010
52 and 64	.192	n.i.	.234	.042
52 and 84	.354	n.i.	.151	.203
63 and 64	.648	n.i.	.725	.077
63 and 84	.377	n.i.	.161	.216
64 and 84	.472	n.i.	.234	.238
51 and 73	.377	.332	n.i.	.045
52 and 73	.436	.354	n.i.	.082
63 and 73	.354	.288	n.i.	.066

*Not identical.

The mean difference between all z values of the intercorrelations of identical clusters was found to be 0.098. This value also represents the mean difference in r values. It is therefore possible to regard as real deviations only those which exceed 0.098.

Before proceeding to the presentation of the results, a few explanations are in order:

1. To show the constancy and number of deviations, the correlations of Set C are presented first, followed by the corresponding correlations of Sets B and A. Deviations are counted according to the second method: All deviations regardless of their size are marked with an asterisk and considered constant when replicated in the same place. The total number of deviations is indicated at the end of each table.

2. The clusters of occupations are marked according to the code outlined in the preceding chapter.

3. The decimal point is throughout omitted from the correlations.

4. The correlation of a variable with itself is obviously 1.00 and is not shown in the tables, a minus sign being used instead.

5. Since the standard deviation of a correlation depends on sample size it was 0.045 in Set C, 0.056 in Set B and 0.059 in Set A. Thus the standard deviation in Set C was the lowest. Hence more importance attaches to deviations in this set than in the other two.

6. Order of presentation: First Roe's contention regarding the simplex structure of each field is examined, seriatim (Service, Business, Organization, etc.). This is followed by tables on the arrangement of the fields by the order of levels —level 1, 2, 3 and 4.

2. EXAMINATION OF GRADED ORDER OF LEVELS IN EACH FIELD

TABLE 9
INTERCORRLEATIONS BETWEEN LEVELS IN EACH FIELD

SERVICE

Set C

cluster	11	12	13	14
11	—	424	• 446	254
12	424	—	518	505
13	446	518	—	457
14	254	505	• 457	—

two deviations

Set B

cluster	11	12	13	14
11	—	421	349 •	371
12	421	—	385	372
13	349	385	—	455
14	371	372	455	—

one deviation

Set A

cluster	11	12	13	14
11	—	451	• 577	312
12	451	—	401	• 486
13	577	• 401	—	483
14	312	486	• 483	—

four deviations

None of the deviations recur in the same place in all three sets. Two deviations recur in the same place in sets C and A.

BUSINESS

Set C

cluster	21	22	23	24
21	—	461	358	260
22	461	—	606	449
23	358	606	—	538
24	260	449	538	—

zero deviations

Set B

cluster	21	22	23	24
21	—	460	257	138
22	460	—	555	376
23	257	555	—	488
24	138	376	488	—

zero deviations

Set A

cluster	21	22	23	24
21	—	533	396	160
22	533	—	446	354
23	396	446	—	395
24	160	354	395	—

zero deviations

There is not a single deviation in all three sets.

ORGANIZATION

Set C

cluster	31	32	33	34
31	—	497	436	416
32	497	—	583 •	603
33	436	583	—	601
34	416	603 •	601	—

two deviations

Set B

cluster	31	32	33	34
31	—	632	605	402
32	632	—	649	420
33	605	649	—	399
34	402	420 •	399	—

one deviation

Set A

cluster	31	32	33	34
31	—	451 •	542	458
32	451	—	481 •	542
33	542 •	481	—	619
34	458	542	619	—

three deviations

None of the deviations recur in the same place in all three sets. Two deviations recur in the same place in two of the sets.

TECHNOLOGY

Set C

cluster	41	42	43	44
41	—	649	535	265
42	649	—	554	313
43	535	554	—	628
44	265	313	628	—

zero deviations

Set B

cluster	41	42	43	44
41	—	635	381	171
42	635	—	350	260
43	381 *	350	—	395
44	171	260	395	—

one deviation

Set A

cluster	41	42	43	44
41	—	552	424	310
42	552	—	592	393
43	424	592	—	578
44	310	393	578	—

zero deviations

There is only one deviation in set B.

OUTDOOR

Set C

cluster	51	52	53	54
51	—	449 *	481	428
52	449	—	537 *	545
53	481	537	—	556
54	428	545	556	—

two deviations

Set B

cluster	51	52	53	54
51	—	554 *	566	546
52	554	—	591 *	613
53	566	591	—	618
54	546	613	618	—

two deviations

Set A

cluster	51	52	53	54
51	—	501 *	535	534
52	501	—	638	560
53	535	638	—	499
54	534	560 *	499	—

two deviations

There are two deviations in each set, one of them recurring in the same place in all three, and one in sets C and B, but not in the same place in set A. The existence of a constant deviation in this field shows that the levels are not arranged according to the hypothesis. After the tables showing the correlations in the remaining fields, this field will be presented again in a different order of clusters.

SCIENCE

Set C

cluster	61	62	63	64
61	—	571	518	449
62	571	—	398	280
63	518 *	398	—	568
64	449 *	280	568	—

two deviations

Set B

cluster	61	62	63	64
61	—	587	541	471
62	587	—	581	488
63	541	581	—	431
64	471	488 *	431	—

one deviation

Set A

cluster	61	62	63	64
61	—	592 *	653	604
62	592	—	456	380
63	653 *	456	—	620
64	604 *	380	620	—

three deviations

None of the deviations recur in the same place in all three sets. Two deviations recur in C and A but not in B.

GENERAL CULTURAL

Set C

cluster	71	72	73	74
71	—	579	459	356
72	579	—	577	550
73	459	577	—	434
74	356	550 *	434	—

one deviation

Set B

cluster	71	72	73	74
71	—	591	530	314
72	591	—	464	346
73	530 *	464	—	430
74	314	346	430	—

one deviation

Set A

cluster	71	72	73	74
71	—	549	481	305
72	549	—	567	465
73	481	567	—	438
74	305	465 *	438	—

one deviation

There is one deviation in each set, recurring in the same place in sets A and C but not in set B.

ARTS & ENTERTAINMENT

Set C

cluster	81	82	83	84
81	—	593	543	477
82	593	—	484	455
83	543 *	484	—	506
84	477 *	455	506	—

two deviations

Set B

cluster	81	82	83	84
81	—	547	496	484
82	547	—	385 *	515
83	496 *	385	—	537
84	484	515	537	—

two deviations

Set A

cluster	81	82	83	84
81	—	542	523	339
82	542	—	480	432
83	523 *	480	—	350
84	339	432 *	350	—

two deviations

There are two deviations in each set, one recurring at the same place in all three, and the other appearing in different places. As in Outdoor, the order of the clusters has to be re-examined to find a possible alternative order of levels.

So far 24 tables have been presented, 3 for each field. At the end of each table the number of deviations from the graded order were noted, and after every three tables the number of constant deviations recurring in the respective field was recorded. The results are summed up in the following table, indicating the number of deviations and in which of the three questionnaire sets they occurred.

TABLE 10
NUMBER OF DEVIATIONS FROM THE GRADED ORDER OF LEVELS, BY FIELD AND BY CONSTANCY OF RECURRENCE

Field	*Set*						
	C, B and A	*C and B*	*C and A*	*B and A*	*Only C*	*Only B*	*Only A*
Service	—	—	2	—	—	1	2
Business	—	—	—	—	—	—	—
Organization	—	1	1	—	—	—	2
Technology	—	—	—	—	—	1	—
Outdoor	1	1	—	—	—	—	1
Science	—	—	2	—	—	1	1
General Cultural	—	—	1	—	—	1	—
Arts & Entertainment	1	—	—	—	1	1	1
TOTAL	2	2	6	—	1	5	7

Only two deviations recurred in the same place in all three sets. Eight deviations recurred in two but not in three sets, of which 6 in sets A and C but not in set B.

As a preliminary conclusion, the existence of a graded order may be inferred. Although the correlations found in Outdoor—the fifth field—and Arts and Entertainment—the eighth field—failed to coincide with this conclusion, it will be shown in the following that the constant deviations in these fields may be eliminated by a rearrangement of the clusters. The recurrence of deviations in two of the three sets, especially in sets C and A, and their appearance in Outdoor and Arts and Entertainment will be discussed after presenting the proposed rearrangement of fields five and eight.

The deviations can also be evaluated by their size. According to this method only deviations of 0.098 (mean difference between correlations of identical clusters) or more would not be considered random. The following table shows the results obtained by this method.

TABLE 11

DEVIATIONS OF 0.098 OR MORE FROM THE ORDER OF LEVELS, BY CONSTANCY OF DEVIATION AND BY FIELD

Field	*Set*						
	Three Sets	*Two Sets*			*One Set*		
	C, B and A	*C and B*	*C and A*	*B and A*	*Only C*	*Only B*	*Only A*
Service	—	—	—	—	—	—	2
Business	—	—	—	—	—	—	—
Organization	—	—	—	—	—	—	—
Technology	—	—	—	—	—	—	—
Outdoor	—	—	—	—	—	—	—
Science	—	—	2	—	—	—	—
General Cultural	—	—	—	—	1	—	—
Arts & Entertainment	—	—	—	—	—	2	—
TOTAL	—	—	2	—	1	2	2
GRAND TOTAL	—	—	4	—	1	2	2

In all the tables there were only 9 deviations of 0.098 or more.

If we rely on constant deviations the original order of the levels in Outdoor and in Arts and Entertainment must be rejected. If we rely on the size of the deviations no change in the original order of the clusters is required.

The first method seems to be better. When in all three replications a deviation appears in the same place, presumably in a fourth replication there would also be a deviation in the same place, however small.

Reshuffling of clusters

The reshuffling does *not* imply different criteria for levels in these fields but only that the respondents' image of levels in these two fields is different from that of the counsellors who classified the occupations.

Fifth Field—Outdoor

In this field the same deviation recurred in all three sets. Another deviation recurred in two of the three sets, and still another was found in set A alone. By reshuffling clusters 51, 52, 53 and 54 in the order 51, 53, 54 and 52, none of the deviations were found to recur at the same place in all three sets. This is shown in the following tables.

OUTDOOR - REVISED ORDER

Set C

cluster	51	53	54	52
51	—	481	428 *	449
53	481	—	556	537
54	428	556	—	545
52	449	537	545	—

one deviation

Set B

cluster	51	53	54	52
51	—	566	546 *	554
53	566	—	618	591
54	546	618	—	613
52	554	591	613	—

one deviation

Set A

cluster	51	53	54	52
51	—	535	534	501
53	535	—	499 *	638
54	534 *	499	—	560
52	501	638 *	560	—

three deviations

Following this rearrangement three deviations occurred in set A, which were, however, replicated in none of the other sets. One deviation recurred in the same place in sets C and B, but not in set A. Once the clusters have been rearranged the empiric findings seem to indicate the existence of a graded order of levels without constant deviations also in this field. The question is, however, to what extent this order, found solely by empirical means, corresponds to the graded order of occupations, having regard to the definitions of each level. A comparison of the names of occupations included in the questionnaire sets according to this empirical order and to Roe's classification is shown in the following table.

TABLE 12

OUTDOOR – NAME OF OCCUPATIONS, BY LEVELS, IN ROE'S CLASSIFICATION AND IN STUDY QUESTIONNAIRES

Level in revised order	*Set C*	*Set B*	*Set A*	*Roe's classification*
1 (1 & 2 of Roe)	Agronomist (agricultural expert) Afforestation expert Farm manager	as in C	as in C	Consulting specialists Applied scientists (agronomists, etc.) Horticulturists Landowners and operators, large Landscape architects Range-management specialists Wildlife specialists
3 (4 of Roe)	Fisherman Farmer Miner (minerals) Sailor	Landscape gardener Poultry farmer Well driller Deck hand	Farmer Miner (minerals) Floriculturist Sailor	Fishermen (owner) Laboratory testers (dairy products, etc.) Landscape gardeners Miners Oil well driller Ore graders Shaftmen
4 (5 & 6 of Roe)	Quarryman (stone) Tractor driver Afforestation worker Shepherd	Miner's helper Cotton picker Dairy hand	Cattle hand Carter Gardener's helper Farm labourer	Farm tenants Cowpunchers Crusher operators Gardeners Hostlers Irrigators Lumber inspectors Miner helpers Nursery employees Oil pumpers Teamsters Trappers Tractor drivers Dairy hands Ditch hands Farm labourers Fishermen Hoboes Lumberjacks.
2 (3 of Roe)	Beekeeper Fishbreeder Citrus grower	as in C	as in C	Apiarists County agents Farmers, individual owner Fish culturists Floriculturists Forest rangers Lumber camp managers Nurserymen (owners) Poultrymen Tree surgeons Truckgardeners Surveyors

Eighth Field—Arts and Entertainment

In this field the same deviation recurred in all three sets. Another deviation was found in different places in each set. After exchanging clusters 81 and 82, no constant deviations were found.

ARTS AND ENTERTAINMENT—REVISED ORDER

Set C

cluster	82	81	83	84
82	—	593	484	455
81	593	—	543	477
83	484	543	—	506
84	455	477	506	—

zero deviations

Set B

cluster	82	81	83	84
82	—	547	385 *	515
81	547	—	496	484
83	385	496	—	537
84	515 *	484	537	—

two deviations

Set A

cluster	82	81	83	84
82	—	542	480	432
81	542	—	523	339
83	480	523	—	350
84	432 *	339 *	350	—

one deviation

Thus there were no deviations whatever in set C. Two deviations remained in set B, one of which was replicated as the sole deviation in set A.

By exchanging clusters 81 and 82, a structure with few deviations, none of them constant, was obtained. Let us now examine the occupations included in these clusters by Roe and by us.

TABLE 13

ARTS AND ENTERTAINMENT—NAMES OF OCCUPATIONS, BY LEVELS, ACCORDING TO ROE'S CLASSIFICATION AND IN THE THREE QUESTIONNAIRE SETS

Level in Revised Order	*Set C*	*Set B*	*Set A*	*According to Roe*
2 ("3" in Roe)	Graphic artist (applied draftsmanship)	Cantor	Stage designer	Advertising writers
		Fashion designer	Graphic artist (applied art)	Designers, clothes, millinery, textiles, tapestries, rugs, etc.
	Ceramicist (artistic pottery)	Applied arts	(As stated, only 2 occupations are presented in this cluster)	Interior decorators
	Vaudeville actor			Magicians
				Music arrangers, popular showmen
				Stage designers, lower level
				Vaudeville performers
1 ("1" & "2" in Roe)	Stage director	Actor	Sports trainer	Creative artists: painters, sculptors, writers, composers, choreographers
	Composer (of music)	Orchestra conductor	Musician	
	Curator of museum (art and antiquities)	Painter	Art critic	Museum curators, fine arts
	Poet	Writer	Dancer (artistic performance)	Performers at highest and average levels: actors, singers, dancers, concert artists, conductors, directors, athletic champions
				Teachers at highest levels and lower levels
				Athletes, professional
				Athletic coaches
				Architects
				Art critics
				Circus performers
				Designers, stage, jewellery
				Music arrangers, orchestral
				Music critics
3 ("4" in Roe)	Accordionist	Jeweller	Photographer	Advertising artists
	Window dresser (decorator)	Piano tuner	Lifeguard (sea or swimming pool)	Decorators, window drapers
	Artistic craftsman—semi-skilled	Stage director's assistant		Illustrators
			Make-up man (theatre)	Monument makers
				Photographers
				Racing car drivers
4 ("5" & "6" in Roe)	Fashion model (mannequin)	Doll painter	Poster painter	Animator artists
	Stage worker (stage helper)	Window dresser's helper	Stage hand	Illustrators, greeting cards
			Chorist (singer in choir)	Photographic technicians
	Sign and poster painter	Chorist (singer in choir)		Show card writers, letter cards
				Stagehands

The contents of the occupations listed by Roe are thus found to correspond to the contents of the occupations presented in the questionnaires. Nevertheless it was necessary to exchange the first two clusters, 81 and 82, so as to obtain a properly graded sequence without constant deviations. A reshuffling of clusters was also required in Roe's fifth field—Outdoor. While cultural differences might have been responsible for certain divergencies in job contents in the fifth field, no such differences were found in the eighth field—Arts and Entertainment. If any, they would be too slight to account for the rearrangement found necessary. It seems that both in the United States and in Israel a vaudeville actor ranks lower than a stage director; the curator of a museum has a higher level than a graphic artist, and a cantor or singer stands no higher than an orchestra conductor. This seems to hold not only for Israel and the United States but for other cultures as well.

Regarding the possibility of an erroneous image prevailing among the respondents with respect to one or both clusters, this might apply to Outdoor where in certain clusters the names of the occupations were repeated in all three questionnaire sets. In Arts and Entertainment, however, the names of the occupations listed in the three sets under the clusters to be exchanged were different. It would be hard to imagine that a misconception should prevail concerning all these occupations.

To our mind the reshuffling of the clusters in two fields, Outdoor and Arts and Entertainment, and of these fields alone, was necessary for reasons connected with their definition. Each of them comprises a wide range of occupations. Roe's definition of Outdoor is (p. 146):

> "This group includes agricultural, fishery, forestry, mining, and kindred occupations: the occupations primarily concerned with the cultivation, preservation, and gathering of crops, of marine or inland water resources, of mineral resources, of forest products, and of other natural resources, and with animal husbandry. All the DOT code 3–occupations, and some others, belong here."

Her definition of Arts and Entertainment is (ibid. p. 147):

> "These occupations include those primarily concerned with the use of special skills in the creative arts and in the field of entertainment. Both creators and performers are included. In the DOT these occupations are classified chiefly in 0–0 through 0–6."

Even the name of this field indicates that it is composed of two parts, whose similarity has yet to be proven. When a field has more than one denominator the grading of the levels becomes problematic, for top grade occupations under one denominator may rank lower than medium grade occupations under another denominator. Just as occupations in the bottom level of one field may not have the same grade as occupations in the bottom level of another field there may be differences in the ranking of occupations comprised under the same level in a given field that has more than one denominator. Deviations in the grading of levels are therefore

to be expected in fields of this kind. According to Roe's classification only Outdoor and Arts and Entertainment come under this category, and in fact these were the only fields in which regular and constant deviations were found.

As stated, these deviations have been obviated by a reshuffling of clusters in two fields. The following table shows the number of deviations in all eight fields after the reshuffling of clusters in two of them.

TABLE 14
DEVIATIONS IN THE REVISED ORDER OF LEVELS, BY CONSTANCY OF DEVIATION AND BY FIELD

Field	*Three Sets*	*Two Sets*			*One Set*		
	C, B and A	*C and B*	*C and A*	*B and A*	*Only C*	*Only B*	*Only A*
Service	—	—	2	—	—	1	2
Business	—	—	—	—	—	—	—
Organization	—	1	1	—	—	—	2
Technology	—	—	—	—	—	1	—
Outdoor	—	1	—	—	—	—	3
Science	—	—	2	—	—	1	1
General Cultural	—	—	1	—	—	1	—
Arts & Entertainment	—	—	—	1	—	1	—
TOTAL	—	2	6	1	—	5	8

A similar summary table showing the number of deviations which exceed 0.098 and recur in the three sets is given below.

TABLE 15
DEVIATIONS OF 0.098 OR MORE FROM THE REVISED ORDER OF LEVELS, BY CONSTANCY OF DEVIATION AND BY FIELD

Field	*Three Sets*	*Two Sets*			*One Set*		
	C, B and A	*C and B*	*C and A*	*B and A*	*Only C*	*Only B*	*Only A*
Service	—	—	—	—	—	—	2
Business	—	—	—	—	—	—	—
Organization	—	—	—	—	—	—	—
Technology	—	—	—	—	—	—	—
Outdoor	—	—	—	—	—	—	1
Science	—	—	2	—	—	—	—
General Cultural	—	—	—	—	1	—	—
Arts and Entertainment	—	—	—	—	—	1	—
TOTAL	—	—	2	—	1	1	3
GRAND TOTAL	0	0	4	0	1	1	3

Thus, of the 31 deviations from the sequence of levels, 13 are bigger than 0.098 and only two of these recur in two sets. All the rest are smaller than 0.098.

Conclusion

The existence of a graded order of levels has been confirmed in all eight fields, but in two only after a rearrangement of the clusters. Hence, in effect all the levels are arranged in a graded order. The hypothetical alternative a_1 in Chapter 9 has thus been proven as correct, and alternative a_2 has been disproven.

In terms of occupational interests, this means that the respondent has a certain level of aspirations in each field, and that his interest decreases the further the occupations in question are removed from his level of aspirations in that field. Thus, if in a given field he is primarily interested in the top level, his interest in the medium levels is still higher than in the lower levels. If he is primarily interested in the bottom level of a certain field, he has a greater interest in the medium than in the top level of this field. If his primary interest lies in level 3, his interest in levels 2 and 4 is higher than in level 1. It is, however, impossible to say whether he is more interested in level 2 or 4, or vice versa.

The data provide not only empirical proof of this rather obvious contention but also translate the results into actual names of occupations. The practical uses of this finding will be discussed in the last part of this book.

Before proceeding to an examination of the second part of the hypothesis, concerning the arrangement of the fields, we should like to discuss one of the data shown in the last table. It is seen from this table that none of the deviations recurs in all three sets. Deviations occurring in one set only can be ignored. Deviations recurring in two out of the three sets are another matter. Though they are not constant it might be said that it is their nonrecurrence in the third set which is fortuitous, rather than their double occurrence in the same place in the other two sets. According to this line of argument the significance of deviations occurring in one set but not in another should be examined on a substantial number of different sets.

The answer to this argument impinges directly upon the function of the replications in the present study. They were not merely intended to examine the constancy of the deviations. An additional purpose was to enable generalization from one list of occupations to others, so that the structure found might be made generally applicable. Deviations are of significance inasmuch as they negate the possibility of generalization, because they tend to indicate absence or irregularity of structure. If the structure of occupations found shows no constant deviations even when the list of occupations in one questionnaire set varies from the others, in part or in whole, there is obviously a wider scope for generalization than if there are no constant deviations between sets listing the same occupations. This means that deviations recurring in the same place in different sets, the list of occupations included in the clusters being identical, do not hamper generalization to the same extent as recurrent deviations in clusters containing different names of occupations.

The next table shows the number of occupations in each cluster by their recurrence in the questionnaire sets.

TABLE 16
FREQUENCY OF RECURRENCE OF THE SAME NAMES OF OCCUPATIONS IN MORE THAN ONE QUESTIONNAIRE SET

Field	*Level*	*Number of Occupations in the cluster*	*Three Sets*	*Two Sets*			*One Set*		
			C, B and A	*C & B*	*C & A*	*B & A*	*Only C*	*Only B*	*Only A*
Service	1	3	—	—	2	—	1	3	1
	2	3	—	—	1	1	2	2	1
	3	4	—	—	—	—	4	4	4
	4	6	—	—	1	—	5	6	5
Business	1	3	2	—	—	—	1	1	1
	2	3	2	—	—	—	1	1	1
	3	3	1	—	1	—	1	2	1
	4	3	1	—	1	—	1	2	1

TABLE 16 (continued)

Field	Level	Number of Occupations in the cluster	Three Sets	Two Sets			One Set		
			C, B and A	C & B	C & A	B & A	Only C	Only B	Only A
Organization	1	3	—	—	1	—	2	3	2
	2	3	1	—	2	—	—	2	—
	3	3	—	—	—	—	3	3	3
	4	3	—	—	—	1	3	2	2
Technology	1	3	—	—	—	—	3	3	3
	2	4	—	—	—	—	4	4	4
	3	8	—	—	—	—	8	8	8
	4	8	—	—	—	—	8	7*	8
Outdoor	1	3	3	—	—	—	—	—	—
	2	3	3	—	—	—	—	—	—
	3	4	—	—	3	—	1	4	1
	4	4	—	—	—	—	4	3*	4
Science	1	4	1	—	—	—	3	3	3
	2	3	2	—	—	—	1	1	1
	3	3	3	—	—	—	—	—	—
	4	3	2	—	1	—	—	1	—
General Cultural	1	4	—	—	—	—	4	4	4
	2	4	2	—	1	—	1	2	1
	3	3	2	1	—	—	—	—	1
	4	3	1	—	1	1	1	1	—
Arts & Entertainment	1	4	—	—	—	—	4	4	4
	2	3	—	—	1	—	2	3	1*
	3	3	—	—	—	—	3	3	3
	4	3	—	—	3		—	3	—
TOTAL		117	26	1	19	3	71	85	68

*The number of occupations in this cluster is not the same as in the other sets – see Chapter 8.

It is seen that names of the same occupations were repeated mainly in sets C and A. This no doubt contributed to the repetition of as many as 6 deviations in both these sets or 4 deviations of more than 0.098, as shown in the preceding tables, whereas in all other possible pairs of sets there were one or two at most.

Since most of the deviations occur between sets containing the same names of occupations, and only a minority occurs in sets containing different names, the hierarchical order of the levels seems to be confirmed.

3. EXAMINATION OF ROE'S ARRANGEMENT OF FIELDS

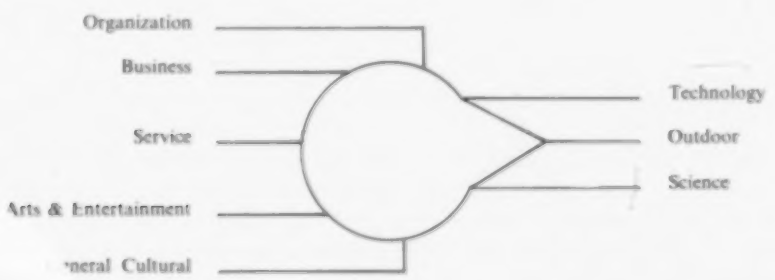
The second part of the hypothesis relates to the structure of the fields, which is stipulated to be circular, with one deviation in the fifth field. This means that the

intercorrelations of any cluster of a given field with other clusters of the same level should be higher the more contiguous the fields of the other clusters are to the field of the cluster in question, according to Roe's arrangement.

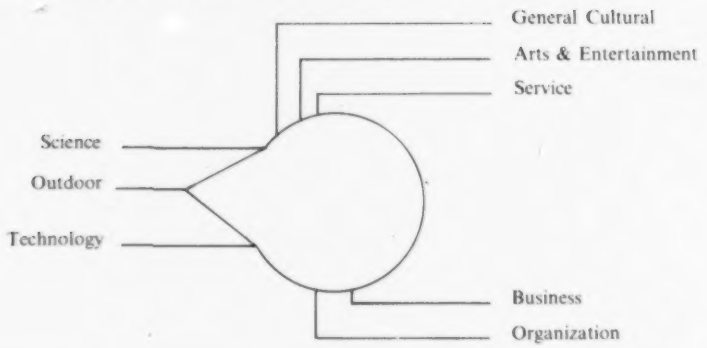
The concept of contiguity requires some elucidation. By hypothesis all the fields except Outdoor are supposed to be located on the circumference of a circle. One of the proportions of a circle is that proceeding from any given point of the circle along the circumference to a second and then to a third point, the third is further removed from the first than the second as long as the points are located along the same half of the circle. If the second and third points are not located on the same half of a circle the distance between the third and the first point might be greater than between the second and the first, but this need not necessarily be so.

In the present study the distances between the points, i.e., the fields, were measured by correlations. According to the hypothesis, the correlations between a cluster of occupations of a given field with clusters of other fields should decrease the further these other fields are removed from the field of the cluster in question, until a certain turning point is reached. The turning point should lie exactly on the opposite side of the circle from the field of the original cluster, but there need not necessarily be a field at this point. Proceeding from the turning point, however, the correlations should again increase. The turning point at which the correlations should cease to decrease and start to increase again is unknown and not defined in the hypothesis.

The practical implication of the fact that the position of the turning point is unknown is that it cannot be known which field is the furthest removed from any given field. Thus, it is not known which field should show the lowest correlation with the field in question. Service, for instance, may show the lowest correlation with Outdoor, if the structure is as follows:



or with Business, if the structure is:



Moreover, to verify the second part of the hypothesis it is necessary to show that the existing correlations are arranged in a circular form—with one deviation, as mentioned. If the hypothesis is correct, all the correlations should easily arrange themselves around the circumference of the circle. Provided most of the correlations are located on the circumference—though some of them are not—it is still possible to assume a circular structure, with certain deviations. Even if the structure of the correlations is not circular by any means, a few correlations may still be located on the circumference of a circle. In this case, however, it would be impossible to say which of them are located on a circle and which are not. It would thus be impossible to locate and therefore to count them.

The following tables show the intercorrelations between the fields, by levels. Since no circular structure without or with only a few deviations was found, the deviations cannot be either located or counted. No notation is accordingly made of the number of deviations in each table.

The following tables show the intercorrelations between the fields, by levels.

TABLE 17

INTERCORRELATIONS BETWEEN FIELDS IN EACH LEVEL

LEVEL 1

Set C

cluster	11	21	31	41	51	61	71	82
11	—	445	469	389	291	600	576	356
21	445	—	582	501	398	548	537	429
31	469	582	—	425	298	540	620	366
41	389	501	425	—	454	560	457	429
51	291	398	298	454	—	399	343	351
61	600	548	540	560	399	—	597	408
71	576	537	620	457	343	597	—	407
82	356	429	366	429	351	408	407	—

Set B

cluster	11	21	31	41	51	61	71	82
11	—	418	488	339	361	402	552	314
21	418	—	591	469	360	371	545	324
31	488	591	—	469	362	360	706	372
41	339	469	469	—	377	490	510	260
51	361	360	362	377	—	440	427	210
61	402	371	360	490	440	—	514	300
71	552	545	706	510	427	514	—	449
82	314	324	372	260	210	300	449	—

Set A

cluster	11	21	31	41	51	61	71	82
11	—	434	521	382	444	632	458	437
21	434	—	576	408	373	480	373	511
31	521	576	—	488	324	496	396	426
41	382	408	488	—	409	456	318	347
51	444	373	324	409	—	433	359	347
61	632	480	496	456	433	—	339	380
71	458	373	396	318	359	339	—	369
82	437	511	426	347	347	380	369	—

There are numerous deviations in every set.

LEVEL 2

Set C

cluster	12	22	32	42	53	62	72	81
12	—	454	657	370	322	285	617	527
22	454	—	381	373	273	211	465	332
32	657	381	—	384	273	308	579	543
42	370	373	384	—	427	426	424	372
53	322	273	273	427	—	246	369	302
62	285	211	308	426	246	—	294	365
72	617	465	579	424	369	294	—	586
81	527	332	543	372	302	365	586	—

Set B

cluster	12	22	32	42	53	62	72	81
12	—	410	486	385	404	358	461	405
22	410	—	424	387	423	353	340	323
32	486	424	—	455	286	362	542	381
42	385	387	455	—	344	510	310	313
53	404	423	286	344	—	275	218	264
62	358	353	362	510	275	—	356	354
72	461	340	542	310	218	356	—	540
81	405	323	381	313	264	354	540	—

Set A

cluster	12	22	32	42	53	62	72	81
12	—	443	521	510	367	386	564	525
22	443	—	564	405	231	315	490	382
32	521	564	—	344	193	225	468	468
42	510	405	344	—	309	358	447	398
53	367	231	193	309	—	241	397	299
62	386	315	225	358	241	—	324	314
72	564	490	468	447	397	324	—	564
81	525	382	468	398	299	314	564	—

There are numerous deviations also at this level.

LEVEL 3

Set C

cluster	13	23	33	43	54	63	73	83
13	—	350	487	493	460	386	527	438
23	350	—	400	537	504	346	384	464
33	487	400	—	423	349	318	502	391
43	493	537	423	—	579	416	520	553
54	460	504	349	579	—	393	405	444
63	386	346	318	416	393	—	340	403
73	527	384	502	520	405	340	—	510
83	438	464	391	553	444	403	510	—

Set B

cluster	13	23	33	43	54	63	73	83
13	—	435	219	228	325	143	491	348
23	435	—	234	217	312	077	454	432
33	219	234	—	302	199	456	436	386
43	228	217	302	—	263	186	251	320
54	325	312	199	263	—	166	262	346
63	143	077	456	186	166	—	282	321
73	491	454	436	251	262	282	—	426
83	348	432	386	320	346	321	426	—

Set A

cluster	13	23	33	43	54	63	73	83
13	—	380	397	393	452	448	487	389
23	380	—	422	491	312	299	353	504
33	397	422	—	385	224	300	531	381
43	393	491	385	—	377	401	524	562
54	452	312	224	377	—	431	327	404
63	448	299	300	401	431	—	376	353
73	487	353	531	524	327	376	—	515
83	389	504	381	562	404	353	515	—

There are numerous deviations also at this level.

LEVEL 4

Set C

cluster	14	24	34	44	52	64	74	84
14	—	503	564	594	396	477	492	523
24	503	—	300	552	245	283	331	383
34	564	300	—	438	334	397	507	442
44	594	552	438	—	402	422	433	541
52	396	245	334	402	—	187	451	341
64	477	283	397	422	187	—	391	445
74	492	331	507	433	451	391	—	475
84	523	383	442	541	341	445	475	—

Set B

cluster	14	24	34	44	52	64	74	84
14	—	530	535	557	423	254	483	384
24	530	—	274	585	242	305	268	236
34	535	274	—	350	385	269	466	370
44	557	585	350	—	427	349	420	389
52	423	242	385	427	—	377	337	325
64	254	305	269	349	377	—	330	411
74	483	268	466	420	337	330	—	330
84	384	236	370	389	325	411	330	—

Set A

cluster	14	24	34	44	52	64	74	84
14	—	341	445	469	321	443	431	302
24	341	—	200	402	185	214	170	329
34	445	200	—	360	199	387	456	270
44	469	402	360	—	278	461	310	329
52	321	185	199	278	—	232	291	151
64	443	214	387	461	232	—	353	227
74	431	170	456	310	291	353	—	256
84	302	329	270	329	151	227	256	—

The same picture is repeated in all three sets. There are many deviations from a circular structure of correlations and not only at the fifth field—Outdoor—which according to Roe's hypothesis should not be interposed between fields four and six—Technology and Science. The deviations are so many that it is sometimes difficult to notice even a trend towards a circular structure of correlations, for it cannot be determined up to what point the correlations decline and from where they again begin to increase. Only cluster 51 in Set B produces a circular structure, without deviations, with the remaining fields, according to the stipulated arrangement (ignoring the difference between 0.360 and 0.361). Otherwise not a single cluster in any of the sets produces a circular structure without deviations.

Not only are there numerous deviations, but some of them recur at the same place in all three sets. Thus in 11 out of 12 instances, the contiguity is greater between Service and Organization than between Service and Business, while according to the hypothesis, Service and Business should be more contiguous.

The hypothesis requires a certain arrangement of the fields. Any other arrangement is covered by the alternative counterhypotheses.

The obvious conclusion is that part of the hypothesis relating to the existence of a circular structure, as suggested by Roe, with or without deviation in the fifth field, is to be rejected.

It will be remembered that the hypothesis consists of two parts. The first part stipulates a simplex structure of levels in each field, while the second requires a circumplex structure—with one deviation—of the fields. Both parts are necessary conditions for the acceptance of the hypothesis and neither part alone is sufficient. Since only the simplex structure of the levels in each field was confirmed, but not the circumplex structure of the fields at any of the levels, Roe's hypothesis must be rejected. The occupations cannot be arranged as suggested by Roe. In statistical terms: there is no radex as there is a simplex but no circumplex.

4. ALTERNATIVE ARRANGEMENT OF THE FIELDS

Of the seven possible alternatives to both parts of the hypothesis, three affirm the existence of a graded order of levels and four deny it. Since a graded order of levels was found to exist but not the arrangement of the fields as suggested by Roe, there remain only three alternatives relating to the structure of the fields:

b_2—the existence of a single arrangement of all fields, other than that suggested by Roe.

b_3—the existence of more than one structure of fields, each including some but not all of them.

b_4—the absence of any structure of fields comprising at least four of them.

For the first of the remaining alternatives to be accepted, a constant alternative arrangement comprising all eight fields has to be found in all three sets. In order

to test this it is again necessary to examine the structure of the fields separately in each level. There are $\frac{1}{2}.7!$, or 2,520 possible alternative arrangements of fields in a circular structure, and $\frac{1}{2}.8!$, or 20,160 possibilities in a linear structure.

The difficulty lies not merely in presenting such a vast number of tables (each in four levels and three sets) but in the very process of carrying out the required examination.

To cope with this tremendous task it is possible on the one hand to apply the trial and error method to the existing data in order to avoid systematic testing of all alternatives. On the other hand the method of elimination may be used, to find out first which arrangements do not fit and thus considerably reduce the possible number of alternatives. Even after the elimination of a large number of alternatives and the establishment of partial structures the number of possibilities is still enormous. In practice it is therefore impossible in this way to arrive at an arrangement which would not show numerous and constant deviations. The use of a computer hardly solves the problem.

There is one possible starting point which might help us in this task, proceeding by trial and error. As mentioned in the last section, Service and Business, which according to Roe should have been more contiguous than Service and Organization, were 11 out of 12 times found to be less contiguous. An arrangement of part of the fields was thus obtained: Service—Organization—Business. An attempt may therefore be made to incorporate the remaining fields within this arrangement.

No arrangement without numerous constant deviations was found, even when only seven fields were included in the structure. Therefore alternative b_2 to the hypothesis, namely that there is a structure of all fields in a different order to that suggested by Roe, must be rejected.

CHAPTER ELEVEN: ANALYSIS OF THE COMPONENTS OF THE FIELDS

1. EXAMINATION OF REMAINING ALTERNATIVES—GENERAL OUTLINE

Now only two alternatives are left. Either there are one or more partial structures comprising four fields at least *(b_3)*, or there is not even any structure of this kind *(b_4)*. Let us try, therefore, to find a structure composed of several fields.

The best way of testing the first alternative *(b_3)* is by component analysis. The theoretical analysis may then be followed up empirically by examination of the corresponding correlations. Conclusions arrived at by this method are the result of logical reasoning and not of computation alone.

The main idea of our component analysis was to examine the contents of the various fields and to select certain specific characteristics of each. These were then classified to find out which fields shared the same characteristics and which did not. The tables in this chapter on the one hand show the characteristics or criteria found to be shared by a number of fields, and on the other a numerical analysis of the presence of the various characteristics in each of these fields.

As implied by the term "component analysis" such characteristics were chosen as are implicit in the description of the field, but sometimes they were not expressly stated in this description or definition but could only be derived from it. If the characteristics were common to all of them, they were discarded, the purpose of the analysis being to establish standard distinctions between the fields. Thus "training" was required for all fields, though in varying amounts, and was not taken into consideration. Material awards were also excluded because this aspect appertains to level rather than to field. By this trial and error method certain characteristics were found to be relevant to one group of fields and less relevant or completely irrelevant to another. The characteristics or components on which the analysis was based were:

1. *Criteria for Evaluation:* Satisfaction vs. effectiveness. Occupations can be evaluated by the amount of satisfaction their exercise gives to others or by their effectiveness, i.e. whether the goals to be attained by the exercise of the occupations have been attained. Thus a nurse is evaluated by the amount of satisfaction she gives to patients, whether they feel better, suffer less, are more willing to undergo treatment, etc. An administrator is evaluated by whether his organization works; a businessman by his sales and profits; a mechanic by whether he makes machines run properly.

2. *Initiative:* How much initiative is required or to what extent routine procedure is followed. A customs inspector, for instance, follows customs regulations which do not usually change overnight and his contact with people is stereotyped. A citrus grower has to contend with the weather and with various pests, soil preservation and water supply—none of them constant—and cope with such variables as competition and market conditions.

3. *Creativeness:* Here the question is whether anything tangible is produced or created. This more or less corresponds to the distinction used by the physiocrats between productive and non-productive labour. Thus a dressmaker obviously makes dresses. On the other hand a real estate broker neither creates, produces nor builds anything but merely acts as the middleman in transactions by which land and buildings are made to change hands.

4. *Interaction with People:* A distinction has been made between occupations which involve direct contact with people and occupations which do not. A grocer has to have contact with his customers and his suppliers; an owner of a workshop with clients, etc. On the other hand a fishbreeder or a shepherd can breed fish or keep sheep without necessarily coming into contact with people. A police officer has to see to it that people keep law and order so that society may be safe, and his immediate dealings usually are with criminals and offenders. A laboratory worker, on the other hand, handles test tubes, slides, cultures, samples and chemicals and even if his ultimate object is to help people he does not deal with them directly.

5. *For the Benefit of Self or Others:* Occupations were classified according to whether they are intended for the benefit of others or one's own benefit. For instance, a dental technician provides people with bridges and dentures and helps them to chew their food better. A tourist guide shows people interesting places and helps them to find their way and enjoy their trip. On the other hand a merchant in a competitive society sells and distributes those goods on which he is able or thinks he is able to make the highest profit for himself, regardless of whether they are the best for the people who buy them; if he takes the customers' preferences into account, he does so more because of potential future profits for himself than for their personal benefits.

6. *Object of Activity:* Whether an occupation deals with material things, or with ideas and abstract matters. Thus a confectioner (pastry cook) makes sweets and cakes while an instructor in a youth club teaches social skills, values, ideals, etc.

Fields consisting of similar components were included in the same sub-structure. Two sub-structures were thus obtained, each having similar components in common. Since some of the components in one sub-structure were irrelevant and inapplicable to the other, and vice versa, the two sub-structures could not be combined.

According to this component analysis it was found that one sub-structure comprises five fields, and another four fields. Two of the eight fields could be included in both sub-structures, and one—Arts and Entertainment—in neither. One sub-structure comprises Service, Business, Organization, Technology and Outdoor; and the other—Service, Business, Science and General Cultural. The component analysis of these sub-structures, and the corresponding intercorrelations for the empirical assay of the resultant findings, are set out in the following sections.

2. THE FIRST SUB-STRUCTURE

The following table shows the components of the fields Service—Organization—Business—Technology—Outdoor. The fields are listed by the degree of similarity of their components.

TABLE 18
FIRST SUB-STRUCTURE OF FIELDS BY COMPONENTS

Field	*Component*			
	(1) *Criteria for Evaluation*	(2) *Initiative*	(3) *Creativeness*	(4) *Interaction with People*
Service	Satisfaction	No	No	Yes
Organization	Effectiveness	No	No	Yes
Business	Effectiveness	Yes	No	Yes
Technology	Effectiveness	Yes	Yes	Yes
Outdoor	Effectiveness	Yes	Yes	No

The table shows that adjacent fields share at least one common component but no component is common to all fields.

These components relate to entire clusters of occupations and are not necessarily shared to an equal extent by all occupations included in the cluster. Since the occupations were not classified by components, some of them may not fit all the components listed as characteristic of the field in which they were included. Their deviate nature may, however, to a large extent be ignored in view of the large number of occupations in each field which do fit the necessary components. Moreover, since the replications include different occupations in most clusters, some of them are always likely to have the right components.

The following table shows the degree of contiguity between the fields on the basis of these components:

TABLE 19
FIRST SUB-STRUCTURE BY THE NUMBER OF DIFFERENT COMPONENTS

Field	*Service*	*Organization*	*Business*	*Technology*	*Outdoor*
Service	—	no. 1	no. 1 no. 2	no. 1 no. 2 no. 3	no. 1 no. 2 no. 3 no. 4
Organization	no. 1	—	no. 2	no. 2 no. 3	no. 2 no. 3 no. 4
Business	no. 1 no. 2	no. 2	—	no. 3	no. 3 no. 4
Technology	no. 1 no. 2 no. 3	no. 2 no. 3	no. 3	—	no. 4
Outdoor	no. 1 no. 2 no. 3 no. 4	no. 2 no. 3 no. 4	no. 3 no. 4	no. 3	—

The difference increases with the number of disparities, in the order shown here. This implies a simplex structure of correlations, as has been shown to exist in respect of the levels in each field.

TABLE 20

INTERCORRELATIONS IN *FIRST* SUB-STRUCTURE

LEVEL 1

Set C

cluster	11	31	21	41	51
11	—	469	445	389	291
31	469	—	582	425	298
21	445	582	—	501	398
41	389	425	501	—	454
51	291	298	398	454	—

zero deviations

Set B

cluster	11	31	21	41	51
11	—	488	418	339 *	361
31	488	—	591	469	362
21	418	591	—	469	360
41	339	469	469	—	377
51	361	362 *	360	377	—

two deviations

Set A

cluster	11	31	21	41	51
11	—	521	434	382 *	444
31	521	—	576	488	324
21	434	576	—	408	373
41	382	488 *	408	—	409
51	444 *	324	373	409	—

three deviations

LEVEL 2

Set C

cluster	12	32	22	42	53
12	—	657	454	370	322
32	657	—	381 *	384	273
22	454 *	381	—	373	273
42	370	384 *	373	—	427
53	322 *	273	273	427	—

four deviations

Set B

cluster	12	32	22	42	53
12	—	486	410	385 *	404
32	486	—	424 *	455	286
22	410	424	—	387 *	423
42	385	455 *	387	—	344
53	404 *	286	423 *	344	—

six deviations

Set A

cluster	12	32	22	42	53
12	—	521	443 *	510	367
32	521	—	564	344	193
22	443	564	—	405	231
42	510 *	344	405	—	309
53	367 *	193	231	309	—

three deviations

LEVEL 3

Set C

cluster	13	33	23	43	54
13	—	487	350 *	493	460
33	487	—	400 *	423	349
23	350	400	—	537	504
43	493 *	423	537	—	579
54	460 *	349	504	579	—

four deviations (at least)

Set B

cluster	13	33	23	43	54
13	—	219 *	435	228 *	325
33	219	—	234 *	302	199
23	435 *	234	—	217 *	312
43	228	302 *	217	—	263
54	325 *	199	312 *	203	—

eight deviations

Set A

cluster	13	33	23	43	54
13	—	397	380 *	393 *	452
33	397	—	422	385	224
23	380	422	—	491	312
43	393 *	385	491	—	377
54	452 *	224	312	377	—

four deviations

LEVEL 4

Set C

cluster	14	34	24	44	52
14	—	564	503 *	594	396
34	564	—	300 *	438 *	334
24	503 *	300	—	552	245
44	594 *	438	552	—	402
52	396 *	334 *	245	402	—

seven deviations

Set B

cluster	14	34	24	44	52
14	—	535	530 *	557	423
34	535	—	274 *	350 *	385
24	530 *	274	—	585	242
44	557 *	350	585	—	427
52	423 *	385 *	242	427	—

seven deviations

Set A

cluster	14	34	24	44	52
14	—	445	341 *	469	321
34	445	—	200 *	360	199
24	341 *	200	—	402	185
44	469 *	360	402	—	278
52	321 *	199 *	185	278	—

six deviations

Let us now summarize the results for levels 1, 2, 3 and 4, and examine the number of deviations by level and constancy.

TABLE 21
NUMBER OF DEVIATIONS IN *FIRST* SUB-STRUCTURE—
SERVICE-ORGANIZATION-BUSINESS-TECHNOLOGY-OUTDOOR

Level	*Three Sets*	*Two Sets*			*One Set*		
	C, B & A	*C & B*	*C & A*	*B & A*	*Only C*	*Only B*	*Only A*
1	—	—	—	1	—	1	2
2	1	2	—	—	1	3	2
3	1	1	2	1	—	5	—
4	6	1	—	—	—	—	—
TOTAL	8	4	2	2	1	9	4

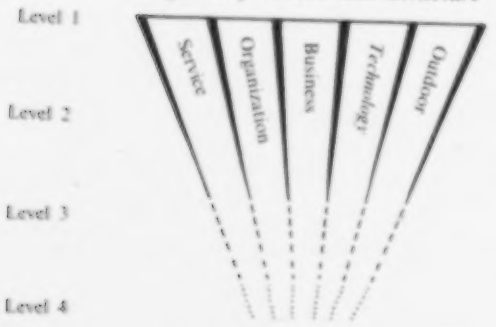
The structure to be expected from the component analysis was empirically confirmed in the top level, but was not found to exist in the bottom level. In level 3 the number of deviations seems too big to warrant its acceptance. Even in level 2 it seems doubtful whether the correlations may be regarded as evidence of the proposed structure, in view of the recurrence of a constant deviation and the considerable number of 3 to 6 deviations in each set.

In the highest level it was found that Service is more contiguous to Organization than to Business, to Business more than to Technology and to Technology more than to Outdoor. Graphically this would mean the following arrangement of fields in level 1:

Service	Organization	Business	Technology	Outdoor

This arrangement was not confirmed in the lower levels, and becomes less applicable in descending order of levels. In level 4 it is distorted to such an extent that one can no longer speak of its existence. Graphically the structure of the fields may thus be represented in the form of a funnel:

Diagram of FIRST Sub-Structure



Let us now examine the deviations from the arrangement of the fields in this sub-structure:

TABLE 22
FIRST SUB-STRUCTURE: DEVIATIONS OF 0.098 OR MORE BY SETS.

Level	*Three Sets*	*Two Sets*			*One Set*		
	C, B and A	*C & B*	*C & A*	*B & A*	*Only C*	*Only B*	*Only A*
1	—	—	—	—	—	—	1
2	—	—	—	1	—	—	1
3	1	—	—	—	1	2	—
4	2	—	1	—	1	1	2
TOTAL	3	—	1	1	2	3	4
GRAND TOTAL	9	—	2	2	2	3	4

There are 22 deviations bigger than 0.098 and at least another 32 minor deviations, some of them in more than one set (counting the minimum of deviant correlations).

This table clearly shows that the first sub-structure can be said to exist only in the higher levels and that the lower the level, the more irregular the structure. In level 4 and apparently also in level 3 the structure no longer can be said to apply. On the other hand there are hardly any deviations from the structure in the higher levels, where it definitely seems applicable.

The practical significance of this finding is that when a boy is interested in the lower level of a given field, there is no alternative field he is likely to prefer. His interests in the remaining four fields are equally strong. On the other hand, when his main interest lies in a higher level of one of the five fields, he is likely, as a second and third choice, to prefer contiguous fields to less contiguous ones.

The practical application of these conclusions will be discussed in Part V. First, however, let us examine the second structure.

3. SECOND SUB-STRUCTURE OF FIELDS

According to the component analysis the second structure comprises the fields Business—Service—Science—General Cultural. The following table shows the components of these fields, which are here marked 5, 6 and 4 to avoid confusion with the components of the preceding structure. The fields are again presented by the degree of similarity in components.

TABLE 23
SECOND SUB-STRUCTURE OF FIELDS, BY COMPONENTS

Field	*Component*		
	(5) *For the Benefit of*	(6) *Object of Activity*	(4) *Interaction with People*
Business	self	material	Yes
Service	others	material	Yes
General Cultural	others	ideas	Yes
Science	others	ideas	No

Again the components do not apply to all occupations included in each field, but we think they are shared by many of them. As in the previous sub-structure the exceptions may be ignored because of the large number of occupations which do conform to the pattern, and because of the variety of occupations listed in the different sets.

Theoretically these fields should thus be arranged in a simplex structure in the order in which they are listed. Business and Service should be contiguous, only one of the three components being dissimilar. In the first sub-structure Organization was interposed between them.

The following table shows the degree of contiguity between these fields, according to the number of common components.

TABLE 24

SECOND SUB-STRUCTURE OF FIELDS, BY NUMBER OF DIFFERENT COMPONENTS

Field	*Business*	*Service*	*General Cultural*	*Science*
Business	—	no. 5	no. 5 no. 6	no. 5 no. 6 no. 4
Service	no. 5	—	no. 6	no. 6 no. 4
General Cultural	no. 5 no. 6	no. 6	—	no. 4
Science	no. 5 no. 6 no. 4	no. 6 no. 4	no. 4	—

The intercorrelations of these fields are shown in the following tables. They are again given separately for each level in the three sets, proceeding from level 1 to 4. The conclusions are presented at the end.

TABLE 25

INTERCORRELATIONS BETWEEN FIELDS—*FIRST* STRUCTURE

LEVEL 1

Set C

cluster	21	11	71	61
21	—	445 *	537 *	548
11	445	—	576 *	600
71	537	576	—	597
61	548	600 *	597	—

four deviations

Set B

cluster	21	11	71	61
21	—	418 *	545	371
11	418	—	552	402
71	545	552	—	514
61	371	402	514	—

one deviation

Set A

cluster	21	11	71	61
21	—	434	373 *	480
11	434	—	458 *	632
71	373	458	—	339
61	480	632 *	339	—

three deviations

LEVEL 2

Set C

cluster	22	12	72	62
22	—	454 *	465	211
12	454	—	617	285
72	465	617	—	294
62	211	285	294	—

one deviation

LEVEL 3

Set C

cluster	23	13	73	63
23	—	350 *	384	346
13	350	—	527	386
73	384	527	—	340
63	346	386 *	340	—

two deviations

Set B

cluster	22	12	72	62
22	—	410	340 *	353
12	410	—	461	358
72	340	461	—	356
62	353	358 *	356	—

two deviations

Set B

cluster	23	13	73	63
23	—	435 *	454	077
13	435	—	491	143
73	454	491	—	282
63	077	143	282	—

one deviation

Set A

cluster	22	12	72	62
22	—	443 *	490	315
12	443	—	564	386
72	490	564	—	324
62	315	386 *	324	—

two deviations

Set A

cluster	23	13	73	63
23	—	380	353	299
13	380	—	487	448
73	353	487	—	376
63	299	448 *	376	—

one deviation

LEVEL 4

Set C

cluster	24	14	74	64
24	—	503	331	283
14	503	—	492	477
74	331	492	—	391
64	283	477 *	391	—

one deviation

Set B

cluster	24	14	74	64
24	—	530	268 *	305
14	530	—	483	254
74	268	483	—	330
64	305 *	254	330	—

two deviation

Set A

cluster	24	14	74	64
24	—	341	170 *	214
14	341	—	431 *	443
74	170	431	—	353
64	214	443 *	353	—

three deviations

The number of deviations, by level and constancy, is summarized in the following table:

TABLE 26

NUMBER OF DEVIATIONS IN *SECOND* SUB-STRUCTURE: BUSINESS—ORGANIZATION—GENERAL CULTURAL—SCIENCE

Level	*Three Sets*	*Two Sets*			*One Set*		
	C, B & A	*C & B*	*C & A*	*B & A*	*Only C*	*Only B*	*Only A*
1	—	1	3	—	—	—	—
2	—	—	1	1	—	1	—
3	—	1	1	—	—	—	—
4	—	—	1	1	—	1	1
TOTAL	—	2	6	2	—	2	1

The correlations seem to confirm the second sub-structure in all levels. A certain number of deviations was to be expected since the occupations, as classified, failed to correspond fully with the determinant components of the fields. The fact that the deviations are not constant in all three sets shows that the inclusion of such occupations was of comparatively little effect.

Graphically, this structure may be represented in the form of a consecutive sequence, in both directions.

DIAGRAM OF SECOND SUB-STRUCTURE

Level 1	B	S	GENERAL CULTURAL	S
Level 2	USI	E R V I C E S		C I E N C E
Level 3	N E			N
Level 4	S S			C E

Taking into account only those deviations which exceed 0.098, the following picture is obtained:

TABLE 27
SECOND SUB-STRUCTURE: DEVIATIONS OF 0.098 OR MORE, BY SETS

Level	*Three Sets*	*Two Sets*			*One Set*		
	C,B & A	*C & B*	*C & A*	*B & A*	*Only C*	*Only B*	*Only A*
1	—	—	—	—	—	1	3
2	—	—	—	—	—	—	—
3	—	—	—	—	—	—	—
4	—	—	—	—	—	—	—
TOTAL	—	—	—	—	—	1	3
GRAND TOTAL	—	—	—	—	—	1	3

There are altogether 4 deviations bigger than 0.098. None of these deviations recur in more than one set. This table furnishes further support for the existence of the second sub-structure.

PART FIVE: *Discussion And Conclusions*

CHAPTER TWELVE: DISCUSSION AND LIMITATIONS

1. GENERALIZATION OF RESULTS

Before discussing the practical application of our findings it is worth while to consider some of the limitations of this study. We shall distinguish between those limitations which can be removed only by further investigation, and apparent limitations which can be at least partially ignored or dispelled.

The investigation was carried out on groups of Israeli boys between the ages of 13 and 13.5 attending ordinary elementary schools. Since a replication was used, it seems that the results can without undue generalization be applied to all Israeli boys of this age. It remains to be asked whether the results also apply to younger or older boys in Israel, to Israeli girls, and to boys and girls of all ages in a different culture. Without further research such generalization seems risky.

2. RESPONSE TO NAMES OR TO OCCUPATIONS

A possible objection to our findings may be that the boys investigated were not familiar with the occupations with which they were presented and reacted to their names rather than to their contents. To obviate this, express instructions were given that any occupation whose meaning was not clear should be crossed out, and that otherwise all occupations should receive a response. Contrary to instructions, however, some boys skipped certain occupations. By the same token it may also be possible that they responded to occupations which were not quite clear to them. If this were so it would mean that the boys and the experts viewed the occupations in a different light.

On the whole it seems that the boys did, however, understand the meaning and contents of the occupations. This is partly confirmed by the fact that the order of intercorrelations between levels corresponded to the experts' classification in six out of eight fields and to some extent also in the remaining two, in one of which it was enough to exchange two contiguous clusters to obtain a regular structure. As regards the classification of occupations into fields, it should be remembered that a definite regular structure by interests was found. Hence, if it is contended that the boys are not sufficiently familiar with the meaning of the names of the occupations, they nevertheless must have a definite stereotyped idea of the different occupations. Since their interests naturally are determined by this stereotyped idea, this would hardly seem to matter.

3. CLASSIFICATION OF BORDERLINE CASES

As discussed in Chapter 3, Roe's system of classification was used. Although the experts agreed on the classification of the vast majority of occupations it might be said that since there were but three experts, at most, they might all have made the same mistake. As a result occupations might have been misclassified as regards field or level or both, and been placed in the wrong cluster. As Flechter has pointed out:

> "with only 48 cells in a system and the tremendous variation in occupations, a great deal of "pushing" and "cramming" has to be done to get all to fit. It is a bit like trying to get every human being with only six specific sizes of shoes." (p. 258).

Roe, too, has pointed out the difficulties inherent in carrying out a classification based on broad empirical hypotheses.

However, it cannot be inferred from this that all or most occupations are likely to have been misclassified. The very fact that the same structures were replicated three times indicate that they were not based on a completely random classification. The probability of this occurring is extremely slight. The contention may stand only with regard to a small minority of occupations. One example of a rather difficult borderline case may suffice.

In this study "graduate nurse" was placed under Service while Roe herself had included this occupation under Science. The reason was the different content of this occupation in Israel. According to Triggs (1947 and 1948) it seems closer to "Science" but according to Shuval (1961) its place seems to be under Service. Since Shuval drew her conclusions from an investigation of the contents of this occupation in Israel, based on questionnaires circulated among Israeli girls, her version was preferred. This is another example of cultural differences affecting occupational classification. Further corroboration is furnished by a comparison of the scores received by other Service occupations in the same level (occupational therapist and psychologist in set C) after eliminating graduate nurse from this cluster, with the top-level Science occupations. This comparison is set out in the following tables:

TABLE 28

SCORES OF GRADUATE NURSE AND SERVICE LEVEL 1*

(CLUSTER 11 AFTER ELIMINATION OF GRADUATE NURSE).

Graduate Nurse	*Service level* 1					*Total*
	0	6	12	18	24	
Y = 2	11	7	15	7	26	66
? = 1	13	5	12	4	3	37
N = 0	189	47	105	22	20	383
Total	213	59	132	33	49	486

$r = 0.350$

TABLE 29

SCORES OF GRADUATE NURSE AND SCIENCE LEVEL 1

(CLUSTER 61)

Graduate Nurse	*Science Level* 1									*Total*
	0	3	6	9	12	15	18	21	24	
Y = 2	6	1	7	4	6	5	17	5	15	66
? = 1	9	4	7	2	2	5	5	2	1	37
N = 0	127	25	63	16	67	20	49	4	12	383
Total	142	30	77	22	75	30	71	11	28	486

$r = 0.317$

It should be remembered that as a result of the elimination of graduate nurse from the cluster there remains only two Service occupations in the Service cluster, which is no longer fully representative, while in the Science cluster all four occupations are left. This may be partially corrected by using Spearman-Brown's formula for the Service cluster. This adjustment shows what would be the correlation between graduate nurse and Service at this level if the Service cluster contained three instead of two occupations, but makes no correction for the possibly changed contents. The adjusted correlation of the Service cluster is 0.447.

The Science cluster included chemist and physician—occupations apparently

* Not included are the responses of 15 boys who skipped graduate nurse and of another two who crossed it out and thus apparently did not understand its meaning.

closely related to nursing – but nevertheless the correlations showed that "graduate nurse" belonged to Service rather than to Science.

An interesting observation is that 13.6 percent of respondents marked "Yes" for "graduate nurse" although it is generally considered a feminine occupation and of feminine gender in Hebrew. To the "masculine" occupations in this cluster only about 10% answered "Yes". This shows how well the subjects understood the instructions that they should give their reactions regardless of whether the occupation appeared in masculine or feminine gender.

4. CLASSIFICATION AND COMPONENT ANALYSIS

A possible objection which might be raised against the structure found by component analysis might be that the classification made according to Roe's definitions does not coincide with the categories obtained from component analysis. In fact it is easy to discern a number of occupations which do not fit into the fields under which they were classified once the contents of these fields are defined according to the components listed in Chapter 1. A certain occupation might belong to Service according to Roe but not according to the first or the second sub-structure found by component analysis. It might be claimed that the final sub-structures obtained for the fields do not correspond to the designations given to them by Roe, and that the fields ought to be relabelled in line with their components.

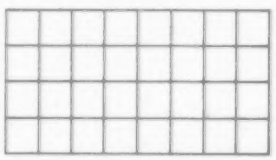
However, although not all the occupations, as classified in the questionnaire inventories, correspond to the definitions used in the component analysis, we think that the vast majority does. No reclassification and relabelling therefore seem necessary. On the other hand, the deviant occupations obviously lead to predictable deviations from the structure. In other words, reclassification according to the component definitions would have reduced the number of deviations found in the two sub-structures.

In this study we set out to test a hypothesis, using a certain classification as a starting point. There may therefore be some objection to the reclassification of certain occupations to better fit the proposed structure, on the grounds that it may have predetermined the results. In further studies, applying the structures found to other age groups, to girls and to different cultural patterns, it may be advisable to use the definitions of the components rather than Roe's definitions as a starting point.

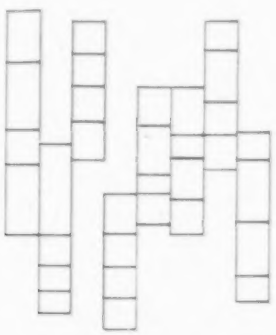
5. POSSIBLE EFFECT OF INEQUALITY OF LEVELS ON ARRANGEMENT OF FIELDS

It might be argued that the levels in each of the eight fields are not arranged symmetrically. A given level in one field need not necessarily correspond to the same level in another. Level 1 in one field might correspond to level 2 in another, and might have no equivalent whatever in a third field. This would mean that the occu-

pations according to Roe's classification do not form a set of rectangles of equal height, ranged along the same line, as shown on p. 151 of *The Psychology of Occupations* (1956), but that the levels in the different fields being unequal and not parallel to one another, the fields vary in size and are not ranged along the same line. Graphically, instead of being arranged in parallel levels, as follows:



the fields would therefore have to be represented by something like the following schematic diagram:

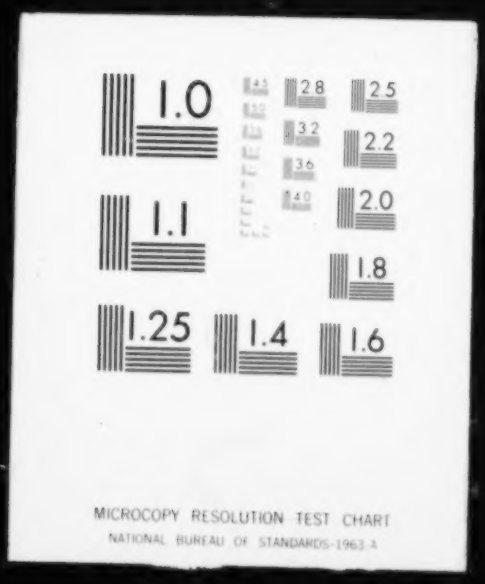


The practical implication is that in order to examine the structure of the fields, the levels of each of the eight fields would first have to be equated. This would, of course, offer no explanation why a worker of professional or managerial status in one field should rank lower in responsibility, capacity or skill than a worker of the same standing in another field, or why a skilled worker in one field should rank lower than a skilled worker in another. It hardly seems reasonable that this should be so. Such a contention would furthermore contradict the basic idea of the independence of levels from fields. Nevertheless there might be minor differences between levels in different fields. An attempt to bring the levels in the eight fields into the same line was therefore made.

Roe divided the fields into levels by the three components of responsibility, capacity and skill. The same procedure was adopted in the present study. Let us now try to match the levels according to the results obtained, by choosing from each field the cluster that best represents a given level. The base point will be the previous matching by which the following clusters were found to best represent level 1:

11 21 31 41 51 61 71 82

2 OF 2
ED
074 237



Next to each cluster we shall set down the clusters from the other fields which have the highest correlation with it. In this way it is easily seen which cluster in each field most closely corresponds to the clusters in level 1. The results for set C are presented in the following table:

TABLE 30

OPTIMAL FIT OF CLUSTERS TO LEVEL 1, SET C

Cluster	*Field*							
	Service	*Business*	*Organization*	*Technology*	*Outdoor*	*Science*	*General Cultural*	*Arts & Entertainment*
11	—	21	31	41	51	61	71	81
21	12	—	31	41	51	61	71	81
31	11	21	—	41	51	61	71	81
41	12	21	32	—	53	61	71	81
51	13	21	32	41	—	61	72	82
61	11	21	31	41	51	—	71	81
71	11	21	31	41	51	61	—	81
82	12	21	32	42	51	61	72	—
Best fit	11 or 12	21	31 or 32	41	51	61	71	81

In Section 2 of Chapter 10 it was shown why in Arts and Entertainment clusters 81 and 82 had to be exchanged to avoid constant deviations from the graded order of levels. As a result, practically all deviations were eliminated, showing the order of clusters in this field to be 82, 81, 83, 84. It is now clear that in this field the cluster corresponding to the top level in the remaining fields is cluster 81. This means that cluster 82 represents a level surpassing the top level of the other fields. In Service and Organization there are two clusters which may qualify for the top level. In set C the highest level may therefore be graphically represented as follows:

```
11     31                82
   21      41 51 61 71 81
12     32
```

In Service and Organization, the cluster directly corresponding to level 1 would thus be an intermediate cluster consisting of a section of two clusters. For the proper scoring of such an intermediate grade separate scores of the different occupations included in each cluster would be necessary, which are not available. A general score for the total response to both clusters provides no solution, because then the top level in these two fields covers a wider range in the other fields. Again the levels would not be parallel, and the same objection would arise.

It is therefore necessary to decide which of the two clusters in these fields are best fitted to represent the top level. Let us test this by comparing which of them matches best with the top clusters in the remaining fields. Cluster 11 is found to match best with clusters 21, 31, 41, 51, 61, 71, 81. Cluster 12 is found to match best with clusters 21, 32, 43, 54, 61, 72, 81.

The best match therefore is:

11		31					
	21		41	51	61	71	81
12		32					

As cluster 11 matches best with other clusters found to belong to level 1, it was preferred over cluster 12. Similarly cluster 31 was found to be preferable to cluster 32.

All the levels in set C were matched according to this procedure. Practically the same combination of clusters was also found to sets B and A. We are not going into the details of the matching procedure of the remaining levels and sets, as we think that one example will be sufficient. The relevant tables are, however, obtainable upon request.*

In set C the following series of matching clusters were obtained:

(1)	11	21	31	41	51	61	71	81	
(2)	12	21	32	41	51	61	71 72	81	
(3)	14	23	34	43 44	54		63 64	73 74	83 84

When it was difficult to decide which of two clusters in a given field corresponded to the required level both were bracketed together, pending further examination as to which of the two shows less deviations. The following tables show the intercorrelations between the clusters when matched by level.

The first series is identical with the top level series in Roe's classification. (In the present study clusters were exchanged in the fifth field—Outdoor—and in the eighth field—Arts and Entertainment.) In all three sets numerous deviations were found in this series. The same applies to the other two series. In order not to take up too much space only the intercorrelations of set C are shown.

* P.O.B. 1406, Jerusalem, Israel.

TABLE 31

INTERCORRELATIONS OF FIRST SERIES OF CLUSTERS IN SET C

cluster	11	21	31	41	51	61	71	81
11	—	445	469	389	291	600	576	469
21	445	—	582	501	398	548	537	580
31	469	582	—	425	298	540	620	454
41	389	501	425	—	454	560	457	457
51	291	398	298	454	—	399	343	337
61	600	548	540	560	399	—	597	505
71	576	537	620	457	343	597	—	549
81	469	580	454	457	337	505	549	—

INTERCORRELATIONS OF SECOND SERIES OF CLUSTERS IN SET C

cluster	12	21	32	41	51	61	71	81	72
12	—	540	657	438	276	448	538	527	617
21	540	—	553	501	398	548	537	580	493
32	657	553	—	431	336	428	509	543	579
41	438	501	431	—	454	560	457	457	454
51	276	398	336	454	—	399	343	337	422
61	448	548	428	560	399	—	597	505	468
71	538	537	509	457	343	597	—	549	—
81	527	580	543	457	337	505	549	—	586

INTERCORRELATIONS OF THIRD SERIES OF CLUSTERS IN SET C

cluster	14	23	34	43	54	63	73	83
14	—	536	564	573	495	468	499	490
23	536	—	436	537	504	346	384	464
34	564	436	—	534	381	381	510	458
43	573	537	534	—	579	416	520	553
54	495	504	381	579	—	393	405	444
63	468	346	381	416	393	..	340	403
73	499	384	510	520	405	340	—	510
83	490	464	458	553	444	403	510	—

INTERCORRELATIONS OF THIRD SERIES OF CLUSTERS
(CLUSTERS OF LOWER LEVEL) IN SET C

cluster	14	23	34	44	54	64	74	84
14	—	536	564	594	495	477	492	523
23	536	—	436	606	504	300	359	436
34	564	436	—	438	381	397	507	442
44	594	606	438	—	597	422	433	541
54	495	504	381	597	—	307	484	479
64	477	300	397	422	307	—	391	445
74	492	359	507	433	484	391	—	475
84	523	436	442	541	479	445	475	—

The evident conclusion is that lack of correspondence between the levels cannot be blamed for the fact that no single arrangement of the fields could be found.

On the other hand, while it is possible by this procedure to determine which cluster of each field best corresponds to the level in question, it cannot be established which cluster matches any given cluster of any other field. Theoretically it is therefore conceivable that the optimal correspondence of levels still may not represent the same levels in different fields. Taking but three fields, it is arguable that they are arranged as follows:

	21	
	22	
	23	
11	24	
12		
13		
14		31
		32
		33
		34

In this case cluster 31, for instance, would show a high correlation with every one of the clusters in the second field, without being of the same level, and its correlation with cluster 13 would be higher than with any of the clusters in the second field.

In practice, however, such extreme differences between the top levels of the various fields are out of the question. The level of occupations was determined on the basis of a number of criteria: responsibility, capacity, skill, and perhaps also several others. It is not possible that a university graduate with experience in his profession and working in a responsible position in one field should have a lower level than unskilled workers in another field. There might be at most a slight divergence in level between the different fields, but it cannot be large. This in fact

does away with the possible objection that a single structure of all fields might be found if the levels were properly matched. Moreover, the levels found by this method give some support to the classification of occupations by levels according to the criteria mentioned in Chapter 3 being independent of the classification by fields.

6. THE QUESTIONNAIRE SETS AS REPLICATIONS

In this study replications were made by using different questionnaire sets and different groups of subjects. The subjects were all selected from the same population and divided at random into three groups, which may therefore be regarded as more or less exact replications of one another. However, since the three questionnaire sets all contained different lists of occupations there may be some doubt as to whether they may be still regarded as replications. It is contended that they are, because the occupations were divided among the three questionnaires by proper matching. The questionnaire sets thus each represent a different sample of the total population of occupations.

The use of replications has the advantage of allowing wider generalization of the results. A structure which fits three replicated sets of inventories is also likely to fit other occupations not included in any of them, much more so than a structure based on one single inventory.

7. REASONS FOR DEVIATIONS IN THE LOWER LEVELS OF THE FIRST SUB-STRUCTURE

In the first sub-structure a considerable number of deviations was found in the lower levels (see Chapter 11). Though these irregularities were found only in one of the two sub-structures, they seem to call for some explanation.

One of the reasons may be the relationship between levels and fields. The distinction between fields seems to be more clear-cut at the higher than at the lower levels. At the lower levels it is the monetary reward which is the worker's main source of satisfaction and causes him to stay at his job, rather than the intrinsic interest he has in his occupation. The degree of interest he finds in his job begins to matter only when there is a shortage of manpower so that he can pick and choose, and wages no longer are the sole criterion. Maslow (1954) in his classification of needs came to the conclusion that the physiological needs were the most basic. Unless they are satisfied none of the others matter very much. Similar views probably guided Fine (1956) in his criticism of Roe's book when he states that he envisages the structure of occupations in the form of a triangle with considerable distinction between occupations at the higher levels and less at the lower levels (p. 260). Also in our component analysis more occupations in the higher levels than in the lower levels corresponded to the components.

If so, it may be asked why one sub-structure shows practically no deviations

The reason may be that in the fields comprised in this sub-structure the distinctions are so clear that they cut through all the way, down to the lower levels.

Whether the supremacy of physiological needs is the right explanation for the deviations in the lower levels or not, what concerns the vocational counsellor in practice are the interests of people of a medium or higher aptitude level. For people below that level, questions of practical placement, the economic resources available to teach them a trade and to bridge them over the period until they earn their own living loom much larger than the question of interest. Hence the lower level occupations are of relatively little practical significance in vocational guidance, and so is their structure.

8. THE STRUCTURE FOUND

In Chapter 6, when discussing our research hypotheses, we said that Roe's conjectured structure corresponded to the requirements of a radex in Guttman's parlance, i.e. a circumplex structure of the fields and a simplex structure of the levels:

> "Radex theory recognizes that mental tests may vary among themselves as to content on at least two facets: differences in *kind* of, and differences in *degree* of, complexity. A simplex may result when the first of these facets is held constant and only the second is varied. Another special case, called a *circumplex*, may result when the second facet is held constant but the first is varied. The general radex case is when both facets vary simultaneously over the given battery of tests." (Guttman, 1957, p. 392).

The existence of a radex was not confirmed by our results. Both sub-structures conformed solely to the requirements of a simplex, both in the arrangement of levels in each field and of the fields themselves (see Chapter 11).

However, as Jones so aptly put it,

> ". . . no structural interpretation is ever final. Whether a structure is correctly or incorrectly applied to a correlation pattern depends on whether the empirical theory behind it is true of false—and about this we can never be quite sure." (Jones, 1960, p. 17).

One of the eight fields of occupations—Arts and Entertainment—does not fit into either of the two sub-structures. A possible reason for this is that the occupations comprised under Arts and Entertainment are not homogeneous enough to form a separate field. It may be that they belong to the remaining fields, or that Arts and Entertainment, as the name implies, is a combination of two fields. As Roe defines this field it includes all occupations which are

". . . primarily concerned with the use of special skills in the creative arts and in the field of entertainment. Both creators and performers are included." (1956, p. 147).

Various studies have pointed to the difficulty of classifying these occupations. Even for occupations which may be grouped under Arts alone, different criteria and sub-divisions have been suggested. Thus Kuder names three factors of literary, artistic, and musical interest. According to Strong these fields are of literary and musical interests. Guilford found two aesthetic factors which he called expression and appreciation. (See Super and Crites, 1962, pp. 383–384.) With respect to the remaining fields the various classifications show less divergence in the criteria used.

There seem to be at least two alternatives: either to divide Arts and Entertainment into two fields, or to distribute it over the remaining fields. In certain instances the second course of distribution over other fields is quite easy and natural. A stage worker (stage helper) can be almost equally well classified under Technology. But most of the occupations cannot be so redistributed. There remains the second alternative of dividing the field into two. Conceivably the resultant two fields may fit into the structure, but with the given material the division cannot be made. In each questionnaire set there are altogether 13 occupations belonging to both Arts and Entertainment, in all 4 levels, i.e. three clusters of 3 and one of 4 occupations. After the division into Arts and Entertainment, i.e. after splitting the clusters, there would at best be only one occupation to represent each of the three new clusters in either Arts or Entertainment. Why no reliance can be placed on a single response has already been discussed in Chapter 7. It therefore seems that Arts and Entertainment must be left out of the structure.

In K.J. Jones' investigation (1965) on a small and not representative group of subjects this field was the only one which did not fit into Roe's suggested order of fields.

Component analysis shows that there are different components in all the fields. "Outdoor", by definition, is a good case in point. It

". . . includes agricultural, fishery, forestry, mining and kindred occupations: the occupations primarily concerned with the cultivation, preservation and gathering of crops, of marine or inland water resources, of mineral resources, of forest products, and of other natural resources, and with animal husbandry." (Roe, 1956, p. 146).

Nevertheless it empirically fits into the first sub-structure together with Service, Organization, Business and Technology. Despite their heterogeneity the Outdoor occupations must therefore have sufficient features in common to offset the difference between them, and as stated in the Introduction, there must be certain differences to be able to speak of different occupations.

An interesting observation is that the two fields which are noted for their lack

of homogeneity – Outdoor and Arts and Entertainment – are the only ones which do not yield the graded order of levels and where a rearrangement was necessary in order to obtain the internal simplex structure of the levels.

Service and Business may also be at first sight considered problematical because they appear in both sub-structures, as they show certain components in common with all the other fields. In practice, however, no special difficulty is encountered. As a rule the subject's scores in all other fields indicate his interests sufficiently to be able to determine whether the alternative to either Business or Service should be taken from a contiguous field in the first or in the second sub-structure.

CHAPTER THIRTEEN: APPLICATIONS

The practical application of the results is two-fold: for vocational guidance and for research. Our specific aim, as indicated in the Introduction, was to find a structure of occupations suitable for vocational guidance purposes.

In vocational guidance practice, the application of the results is envisaged as follows. When a boy comes to the counsellor he is given one of the three questionnaire sets as part of the general battery of tests administered. With the aid of indexes prepared in advance he is given a score for all 32 clusters according to his aggregate response to the occupations included in each cluster. From this set of scores conclusions may be drawn as to:

a) The fields in which he is more interested and the fields in which he is less interested (aggregate score in each field).
b) His level of aspirations (aggregate score in each level).
c) The focus or foci of his interests (comparison of all scores).
d) The extent to which his interests have crystallized and matured (i.e. whether he scored higher in clusters contiguous to his focal interests or not).

If the subject has answered a similar questionnaire (of the same or another set) before, it is also possible to trace his development towards occupational maturity during the intervening space of time, i.e. whether his interests are more consolidated in the later questionnaire. Since the inventory of occupations is given at random there is no great risk of his remembering his previous replies. Observations of this kind were one of the objects of Moser, Dubin and Shelsky's classification (1956).

Once the subject's focus of interest has been ascertained, it is then possible to see what type of occupations he prefers in addition to those listed in the questionnaire. The results may be applied to all the occupations in the cluster.

If for various reasons—e.g. physical disability, lack of necessary funds to learn a particular occupation—the boy is unable to engage in any of the occupations included in the cluster in which he is particularly interested, occupations in clusters of contiguous fields in the two sub-structures may be offered as alternatives. If it is found that the boy does not have the necessary aptitude for the occupations listed in the cluster of his choice, he may be advised to choose some other occupations in the same field but of a lower level. It is very rare for a boy to have aptitudes greater than his interests, so that he would find no satisfaction in the occupation of his choice which does not offer sufficient chances of promotion, but if this should happen it is possible to suggest occupations of a higher level in the same field.

If necessary it is of course possible to work in both directions: to suggest another field in the same sub-structure and to vary the level according to the subject's aptitude, aspirations, etc.

This can be done by comparing the subjects' response to the inventory question-

naire with their direct preference. In our questionnaire a few lines were left blank and respondents were allowed to insert additional preferences not included in the inventory. Let us take the example of a subject who added "bacteriology or another occupation in the field of biology." His questionnaire score was as follows:

FIRST AND SECOND SUB-STRUCTURES (ONE SUBJECT)

FIRST SUB-STRUCTURE

Level	*Field*				
	Service	*Organization*	*Business*	*Technology*	*Outdoor*
1	16	16	12	8	20
2	0	0	0	6	4
3	3	0	0	2	3
4	0	4	4	0	0

SECOND SUB-STRUCTURE

Level	*Field*			
	Business	*Service*	*General Cultural*	*Service*
1	12	16	15	18
2	0	0	6	16
3	0	3	12	0
4	4	0	0	0

In Arts and Entertainment, a field included in neither sub-structure, his scores, by level, were: 9, 12, 0, 0 in levels 1, 2, 3 and 4. The first sub-structure reveals no distinct interest but indicates a high level of aspirations. The same high level of aspirations also appears in the second sub-structure, but here there is a clear preference for Science and General Cultural. Obviously his interests lie in the field of natural sciences—as a researcher or as a teacher. (Roe classified biology under Science although others, like Super, assign a special category to these occupations.) Since his aptitudes were in line with his interests he seemed to have every chance of attaining his aspirations. This boy was therefore advised to take the Science course in secondary school. Another example where the interests were less clear-cut is the following:

FIRST AND SECOND SUB-STRUCTURES (ANOTHER SUBJECT)

FIRST SUB-STRUCTURE

Level	*Field*				
	Service	*Organization*	*Business*	*Technology*	*Outdoor*
1	12	24	20	24	20
2	12	8	16	24	0
3	15	16	12	12	15
4	6	8	12	9	3

SECOND SUB-STRUCTURE

Level	*Field*			
	Business	*Service*	*General Cultural*	*Science*
1	20	12	18	18
2	16	12	9	16
3	12	15	20	12
4	12	6	12	4

In Arts and Entertainment this subject scored, by level, 15, 20, 16, 16.

This boy had a wide and varied range of interests and his scores showed no clear predilection for any given field. The level of aspiration is not very high compared with other subjects, and ranges between levels 2 and 3. This impression was confirmed by the boy's answer to the direct question at the end of the questionnaire. He wrote in the following order: airplane technician, bookkeeper and gym teacher. There seems to be no classification of occupations which would put these three occupations in the same category. The only thing they have in common is that they are all at level 2–3. However, they belong to the fields Technology, Organization and General Cultural, and indeed this boy scored higher in these fields than in any of the others, apart from Business—perhaps because Business lies between Organization and Technology in the first sub-structure, the two fields in which the boy was primarily interested. Airplane technician and bookkeeper figure under Technology and Organization in set B, and gym teacher—under General Cultural in set A. It is thus seen that from this boy's reactions to other occupations in the same fields where his main interests lay, inferences may be drawn as to his interest in occupations not listed in the questionnaire.

This procedure, as illustrated by the above examples, also furnishes evidence of the content validity of the questionnaire.

SUMMARY AND CONCLUSIONS

An attempt was made to find a structure of occupations.

1) A graded order of levels of occupations was found in each of the following eight fields: Service, Business, Organization, Technology, Outdoor, Science, General Cultural, Arts & Entertainment.

2) The following 5 fields were found to be arranged in a simplex structure: Service —Organization—Business—Technology—Outdoor. The structure was fully confirmed in the higher levels but is less clear-cut in the lower levels.

3) Another simplex structure was found comprising the following fields: Business—Service—General Cultural—Science.

4) The field Arts & Entertainment could not be incorporated in either structure while Business and Service appeared in both.

5) The same findings were made in three replications (three questionnaire sets and three groups of subjects), so that considerable generalization is possible.

6) On the basis of the structures found, more accurate occupational counselling can be provided.

SAMENVATTING

In dit werk is een poging gedaan een methode te vinden, die meer gegevens omtrent de relatie tussen belangstelling en beroep zal opleveren en die daardoor van nut kan zijn bij de beroepskeuze.

De bestaande beroepenclassificaties maken meestal een indeling in groepen die onderling geen vaste relatie hebben, zodat iedere groep een willekeurige plaats in het schema inneemt. Wij echter hebben ernaar gestreefd een indeling van de beroepen te verkrijgen, zodanig dat de verwantschap naar interessen in de verschillende groepen duidelijk blijkt.

Om dit te bereiken is uitgegaan van een bestaande classificatie, die hetzelfde doel nastreeft. De indeling van Roe, met een niveaugradatie in zes klassen en een sector-indeling in acht beroepenfamilies leek het beste aan onze eisen te beantwoorden. Alleen werd met het oog op toepassing in Israël het aantal niveauklassen tot vier gereduceerd, zodat dus 32 combinaties van klassen en families mogelijk waren.

Om na te gaan, of uit deze classificatie een passend schema kan worden afgeleid, ontwierpen wij een test, bestaande uit drie vragenlijsten, die elk 117 beroepsnamen bevatten. Voor de samenstelling van deze test werden eerst door twee deskundigen een groot aantal beroepen ingedeeld volgens Roe's classificatie. Deze beroepen werden vervolgens over de drie vragenlijsten verdeeld, zodanig dat beroepen, behorende tot dezelfde klasse en familie, zoveel mogelijk gelijkelijk werden verspreid. De vragenlijsten bevatten daardoor als regel verschillende beroepen. Een uitzondering werd gemaakt, wanneer het aantal beroepen, ingedeeld in een specifieke combinatie van klasse en familie, onvoldoende was om in elke vragenlijst tenminste drie beroepen te kunnen opnemen.

De test werd gebruikt voor het onderzoek van ruim 1000 Israëlische jongens van 13 en 14 jaar, allen leerling van de hoogste (d.i. achtste) klas van de lagere school. Zij werden verdeeld in drie groepen van resp. 503, 321 en 290 jongens, die elk één vragenlijst voorgelegd kregen.

Gevraagd werd de in de lijst genoemde beroepen met J (ja) of N (neen) to beoordelen, om daarmee aan te geven, of de betrokkene wel of geen belangstelling voor het beroep in kwestie had. In geval van twijfel kon een vraagteken worden geplaatst. Door aan iedere reactie een cijferwaardering toe te kennen kon voor iedere respondent voor elk der 32 combinaties van klassen en families een somscore worden bepaald.

Deze somscores dienden om de product-moment correlaties tussen de voorkeuren voor de 32 combinaties te berekenen. De berekening geschiedde voor elk der drie proefgroepen afzonderlijk. Het was daardoor mogelijk het onderzoek in drievoud uit te voeren en zodoende de invloed van toevalsfactoren te reduceren.

Op grond van het systeem van Roe konden een aantal hypothesen worden gesteld ten aanzien van de onderlinge verwantschap tussen de diverse combinaties

van families en klassen, zoals deze blijkt uit de grootte van de correlatiecoëfficiënten.

De voornaamste uitkomsten waren:

1. Er bleek dezelfde hiërarchie van niveauklassen te bestaan binnen ieder van de volgende 6 beroepenfamilies: Service, Business, Organization, Technology, Science, General Cultural.
Binnen de families Outdoor en Arts & Entertainment werd wel een klasse-hiërarchie gevonden, die echter niet beantwoordde aan de rangschikking binnen de overige families.

2. De volgende 5 beroepenfamilies werden in een simplex schema gerangschikt: Service—Organization—Business—Technology—Outdoor.
Dit schema bleek in de hogere beroepsklassen geheel bevestigd te zijin, maar in de lagere—klassen waren de uitkomsten minder duidelijk.

3. Een ander simplex system bleek de volgende beroepenfamilies te omvatten: Business—Service—General—Cultural—Science.

4. De beroepenfamilie Art & Entertainment kon niet in een schema worden ondergebracht, terwijl Business en Service in beide voorkwamen.

5. Alle drie vragenlijsten leverden het zelfde resultaat op.

6. Op grond van de aldus opgebouwde schema's is het mogelijk de beroepskeuzevoorlichting te verbeteren.

APPENDIX A:

DEFINITION OF LEVELS USED BY VAN MILL AND BY ANNE ROE

VAN MILL (1952, pp. 5–6)

LEVEL 7:

Practical work on a scientific basis or purely scientific work.

LEVEL 6:

Highly complex work requiring evident talents, completion of regular (not technical) high school as well as practical experience.

LEVEL 5:

Complex work, requiring evident talents, much practical experience as well as theoretical knowledge.

LEVEL 4:

Somewhat complex work requiring thought and initiative, rather extensive practical experience and if possible some theoretical knowledge.

ANNE ROE (1956, pp. 149–150)

LEVEL 1:

PROFESSIONAL AND MANAGERIAL 1: INDEPENDENT RESPONSIBILITY. This Level includes not only the innovators and creators, but also the top managerial and administrative people, as well as those professional persons who have independent responsibility in important respects. For occupations at this Level there is generally no higher authority, except the social group. Several criteria are suggested: a. Important, independent, and varied responsibilities. b. Policy-making. c. Education: When high-level education is relevant (it is not required in the creative arts, for example, or a necessity for dictators, or even for our own high government officials) it is at the doctoral level or the equivalent.

LEVEL 2:

PROFESSIONAL AND MANAGERIAL 2: The distinction between this Level and Level 1 is primarily one of degree. Genuine autonomy may be present but with narrower or less significant responsibilities than in Level 1. Suggested criteria are: a. Medium-level responsibilities, for self and others, both with regard to importance and variety. b. Policy interpretation. c. Education at or above the bachelor level, but below the doctorate or its equivalent.

LEVEL 3:

SEMI-PROFESSIONAL AND SMALL BUSINESS. The criteria suggested here are: a. Low-level responsibility for others. b. Application of policy, or determination for self only (as in managing a small business). c. Education, high school plus technical school or the equivalent.

LEVEL 4:

SKILLED. This and the following levels are classical subdivisions. Skilled occupations require apprenticeship or other special training or experience.

LEVEL 3:

Moderately complex work requiring understanding and thought as well as several months' experience.

LEVEL 2:

Simple work which requires some understanding and thought but can be done after several weeks' experience.

LEVEL 1:

Very simple work not requiring much thought which can be done after a few days' experience.

LEVEL 5:

SEMI-SKILLED. These occupations require some training and experience but markedly less than the occupations in Level 4. In addition, there is much less autonomy and initiative permitted in ..iese occupations.

LEVEL 6:

UNSKILLED. These occupations require no special training or education and not much more ability than is needed to follow simple directions and to engage in simple repetitive actions. At this Level, Group differentiation depends primarily upon the occupational setting.

APPENDIX B:

OCCUPATIONS INCLUDED IN THE THREE QUESTIONNAIRE SETS

	Set C	*Set B*	
		SERVICE	
LEVEL 1			
	Psychologist	Probation Officer	Educational consultant
	Occupational therapist	Social worker	Occupational therapist
	Graduate nurse	School nurse	Graduate nurse
LEVEL 2			
	Midwife	Cosmetician	Matron (boarding school)
	Police officer	Army officer	Army officer
	Vocational guidance officer at Labour Exchange	Adjutant	Vocational guidance officer at Labour Exchange
LEVEL 3			
	Male hospital nurse	Children's nurse	Medical orderly
	Air hostess	Cook	Dietician
	Soldier (regular army)	Policeman	Baby nurse
	Confectioner (pastry cook)	Hairdresser	Hotel worker
LEVEL 4			
	Supernumerary policeman (guard of public buildings)	Prison guard	Fireman (fire brigade)
	Cook	Stall keeper (buffet)	Waiter
	School janitor	Manicurist (treatment of hands)	Lift operator
	Bus ticket collector	Train conductor	Bus ticket collector
	Hotel chambermaid	Charwoman	Household help (worker)
	Porter	Watchman	Usher
		BUSINESS	
LEVEL 1			
	Bank manager	Manager of big commercial firm	Shopkeeper
	Advertising agent	Advertising agent	Advertising agent
	Economist	Economist	Economist
LEVEL 2			
	Real estate broker (flats)	Real estate broker (flats)	Real estate broker (flats)
	Wholesale merchant	Wholesale merchant	Wholesale merchant
	Commercial agent	Travel agent	Insurance agent
LEVEL 3			
	Salesman	Merchant	Salesman
	Grocer	Grocer	Grocer
	Salesman of building material	Salesman in toyshop	Salesman in shoe shop

	Set C	*Set B*	*Set A*
LEVEL 4			
	Salesman in kiosk	Newspaper vendor	Greengrocer
	Milkman	Pedlar	Cigarette vendor
	Greengrocer	Greengrocer	Salesman in kiosk
		ORGANIZATION	
LEVEL 1			
	Certified accountant	Treasurer of big firm	Auditor
	Diplomat	Knesset member (MP)	Factory owner
	Personnel manager in government office	Factory owner	Personnel manager in government office
LEVEL 2			
	Income tax assessing officer	Income tax assessing officer	Income tax assessing officer
	Trade union secretary	Post office manager	Trade union secretary
	Customs inspector	Labour inspector	Customs inspector
LEVEL 3			
	Cashier	Operator of calculating machine	Tax collector
	Secretary	Bookkeeper	Clerk
	Post office clerk	Bank clerk	Shorthand writer
LEVEL 4			
	Filing clerk	Typist	Typist
	Postman	Storekeeper	Telephone operator
	Information desk officer	Messenger	Bill poster
		TECHNOLOGY	
LEVEL 1			
	Ship's captain	Ship's officer	Ship's pilot
	Industrial chemist	Production engineer	Civil engineer
	Mechanical engineer	Electrical engineer	Mechanical (agricultural) engineer
LEVEL 2			
	Radio technician	Electronics mechanic	Telecommunications technician
	Aircraft pilot	Aircraft technician	Aircraft electrician
	Draftsman (technical drawing)	Land surveyor	Building contractor
	Owner of workshop	Foreman in industry	Industrial mechanic
LEVEL 3			
	Motor car electrician	Electrician (instruments)	Refrigeration electrician
	Builder	Scaffolding erector	Stone mason

Set C	*Set B*	*Set A*
Lithographer (for printing of pictures)	Printer	Compositor
Turner (working on lathe)	Cabinet maker	Watch repairman
Diamond polisher	Fine mechanics worker	Weaver
Mechanical knitter	Bookbinder	Motor car mechanic
Structural metal worker	Metal worker	Plumber
Dressmaker	Dressmaker	Tailor
LEVEL 4		
House painter	Tile layer	Wall painter (white-wash)
Baker	Butcher	Laundryman
Ironer (clothes pressing)	Spinner	Seamstress-factory work
Driver of steamroller	Welder	Metal plater
Wood polisher	Building carpenter	Glazier
Straw and bast weaver	Shoemaker	Upholsterer
Factory worker	Fruit packer	Building worker
Tyre repairman	[only seven occupations]	Suitcase and handbag repairman
	OUTDOOR	
LEVEL 1		
Agronomist (agricultural expert)	Agronomist (agricultural expert)	Agronomist (agricultural expert)
Afforestation expert	Afforestation expert	Afforestation expert
Farm manager	Farm manager	Farm manager
LEVEL 2		
Beekeeper	Beekeeper	Beekeeper
Citrus grower	Citrus grower	Citrus grower
Fishbreeder	Fishbreeder	Fishbreeder
LEVEL 3		
Farmer	Landscape gardener	Floriculturist
Fisherman	Poultry farmer	Farmer
Miner (minerals)	Well driller	Miner (minerals)
Sailor	Deckhand	Sailor
LEVEL 4		
Quarryman (stone)	Miner's helper	Carter
Tractor driver	Cotton picker	Gardener's helper
Shepherd	Dairy hand	Cattle hand
Afforestation worker	[only three occupations]	Farm labourer

SCIENCE

Set C	*Set B*	*Set A*
LEVEL 1		
Doctor (physician)	Veterinarian	Surgeon
University professor in natural sciences	Scientist (researcher)	Mathematician
Chemist	Meteorologist	Pharmacist
Theatre nurse (surgical)	Theatre nurse (surgical)	Theatre nurse (surgical)
LEVEL 2		
X-ray technician	Orthopedic technician	Massagist (treatment by massage)
Laboratory worker	Laboratory worker	Laboratory worker
Dental technician	Dental technician	Dental technician
LEVEL 3		
Dental assistant	Dental assistant	Dental assistant
Pedicurist (treatment of feet)	Pedicurist (treatment of feet)	Pedicurist (treatment of feet)
Laboratory assistant	Laboratory assistant	Laboratory assistant
LEVEL 4		
Hospital worker	Hospital worker	Hospital worker
Pharmacist's help	Veterinar's help	Pharmacist's help
Laboratory cleaner	Laboratory cleaner	Laboratory cleaner

GENERAL CULTURAL

LEVEL 1		
University professor in humanities	Archaeologist	Librarian
Judge	Lawyer	Rabbi
Publisher (of books)	Translator	Journalist
Secondary school teacher	School inspector	Kindergarten inspector
LEVEL 2		
Handicrafts teacher	Domestic science teacher	Gym teacher
Nursery school teacher	Nursery school teacher	Nursery school teacher
Tourist guide	Radio announcer	Tourist guide
Elementary school teacher	Elementary school teacher	Elementary school teacher
LEVEL 3		
Youth club instructor	Youth club instructor	Folkdancing instructor
Ritual scribe (writer of Torah scrolls & mezuzot)	Ritual scribe (writer of Torah scrolls & mezuzot)	Ritual scribe (writer of Torah scrolls & mezuzot)
Proofreader	Proofreader	Proofreader

	Set C	*Set B*	*Set A*
LEVEL 4	Nursery school teacher's assistant Record librarian in broadcasting station Worker in archaeological diggings	Nursery school teacher's assistant Librarian's assistant Usher in court	Nursery school teacher's assistant Worker in archaeological diggings

ARTS & ENTERTAINMENT

LEVEL 1	Stage director Composer (of music) Curator of museum (arts and antiquities) Poet	Actor Orchestra conductor Writer Painter	Art critic Musician Sports trainer Dancer (artistic performance)
LEVEL 2	Graphic artist (applied draftsmanship) Vaudeville actor Ceramicist (artistic pottery)	Fashion designer Cantor Applied artist	Graphic artist (applied draftsmanship) Stage designer [only two occupations]
LEVEL 3	Window dresser (decorator) Artistic craftsman semi-skilled Accordionist	Stage director's assistant Jeweller Piano tuner	Lifeguard (sea or swimming pool Photographer Make-up man (theatre)
LEVEL 4	Fashion model (mannequin) Sign & poster painter Stage worker (stage helper)	Window dresser's helper Doll painter Chorist (singer in choir)	Fashion model (mannequin) Sign & poster painter Stage worker (stage helper)

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CODING OF CLUSTERS OF OCCUPATIONS

	Field							
Level	*Service*	*Business*	*Organization*	*Technology*	*Outdoor*	*Science*	*General Cultural*	*Arts & Entertainment*
1	11	21	31	41	51	61	71	81
2	12	22	32	42	52	62	72	82
3	13	23	33	43	53	63	73	83
4	14	24	34	44	54	64	74	84